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GREATER LOCAL FOOD PRODUCTION.

The results of the efforts that were made with the North-East Monsoon are now beginning to come to hand. The reports that have been received by the Department of Agriculture and the Agricultural Society are, on the whole, favourable.

A decided effort has been made throughout the various districts of the colony to produce a greater quantity of food-stuffs, vegetables and curry-stuffs.

Visits to estates up-country show that greater attention has been paid by estate labourers to their vegetable gardens. They are more cared for and fuller of produce than formerly. There have been some disappointments and some estate managements have undertaken to demonstrate that these cultivations are to the interest of the labourers.

A greater production of manioc, yams, sweet potatos and other tubers is this year assured. An effort to encourage the cultivation of these crops in the principal rubber-growing areas has been made. In one section of the Kalutara district an increase of over 100 acres is recorded, and this is mainly under yam crops and vegetables.

In the Northern districts the cultivation of curry-stuffs have not given satisfactory results and unfavourable results are also recorded from the Hambantota division of the Southern Province.

This division suffered from a spell of drought in October, which greatly interfered with the North-East monsoon cultivations.

In the Sabaragamuwa Province coriander and aniseed is growing satisfactorily and favourable reports have also been received from certain parts of the North-Western Province, but the most favourable reports in regard to curry-stuffs have been received from the Walapane district of the Central Province and from certain parts of Uva.

The coriander and aniseed crops at Harasbedde Demonstration Garden are most satisfactory and these crops have grown well in the chenas of that district. It would therefore appear that the higher and drier parts of the colony are likely to be quite suited to the cultivation of certain curry stuffs, and it is to be noted that already small quantities of locally grown curry stuffs have found their way to the Welimada bazaars.

The general results of the various trials may be summarized as follows :—Onions succeed in many districts and much larger quantities could be grown with profit. The output of chillies could be considerably increased and our dependence upon the imported article reduced. Dhall (*Cajanus Indicus*) has grown most luxuriantly in all districts and has yielded heavy crops. A great extension of this pulse could readily be secured, as well as of green gram, kollu and other pulses that the colony at present import. Aniseed is at present being grown in the Matale district with success and it has also grown well in various other localities. Coriander is suited to the cooler and drier altitudes, and fenugreek might be grown successfully. Cumin is really the only disappointment. Germination has been poor and growth unsatisfactory. Further trials with this crop will have to be undertaken.

From the above it will be gathered that useful information has already been obtained. The colony can grow much greater quantities of its food requirements, and steps are being taken for making further efforts towards encouraging this cultivation with the south-west season beginning in May and June.

CEYLON AGRICULTURE.

COMMITTEE OF AGRICULTURAL EXPERIMENTS.

Minutes of a meeting of the Committee of Agricultural Experiments held at the Experiment Station, Peradeniya, on 7th February, 1918.

Present :—The Director of Agriculture (Chairman); the Botanist and Mycologist; the acting Entomologist; the Government Chemist; the Superintendent, Botanic Gardens; the Superintendent, Low-Country Products and School Gardens; the Hon'ble the Government Agent, C.P.; the Hon'ble the Rural Member of the Legislative Council; the Chairman, Planters' Association of Ceylon; MESSRS. A. E. DE S. RAJAPAKSE Mudaliyar, J. B. COLES, E. W. KEITH, T. Y. WRIGHT, R. G. COOMBE, J. S. PATTERSON, W. SINCLAIR, H. D. GARRICK, A. S. LONG-PRICE, N. G. CAMPBELL, G. H. MASEFIELD, A. J. AUSTIN DICKSON, G. H. GOLLEDGE, and H. A. DEUTROM (Acting Secretary); and as visitors, MESSRS. H. STOREY, ALEX. PERERA, H. A. BEACHCROFT, R. AGAR, G. O. TREVALDWYN, R. WILKINSON, C. A EVANS and E. C. VILLIERS.

The minutes of the previous meeting having been confirmed, the Chairman stated that letters and telegrams expressing inability to attend had been received from LT.-COL. DICKSON, MESSRS. M. L. WILKINS, N. J. MARTIN, and the Assistant Government Agent, Puttalam.

2. *Progress Reports.*—The Chairman announced that as the Progress Reports were not ready in time for circulation they had to be tabled. The Chairman stated that there was an increase of Shot-hole borer in the Experiment Station Tea plots, and that MR. SPEYER was carrying out experiments with various insecticidal mixtures. He reviewed the work of the Experiment Stations, as detailed in the reports, and called for comments. He stated that at Anuradhapura the oil palms were doing very well. Coffee robusta was bearing quite good crops and the paddy was making most satisfactory growth.

MR. T. Y. WRIGHT enquired what was the age of the Robusta coffee at Anuradhapura, and whether it was being grown under irrigation. The Chairman stated that the plants were now 3 years old and that they were regularly irrigated.

On an enquiry by MR. J. S. PATTERSON, the Chairman stated that Rs. 13·75 was the highest offer received for coconuts at the auction sale, but the highest bidder eventually undertook to buy the nuts at Rs. 15 per 1,000. MR. LONG-PRICE thought that this was a fair price for November, when the sale was held. The Progress Reports were then adopted.

3. *The best Way of Preserving Coconuts in Husks*—This question was to have been brought up by MR. MARTIN, who was unfortunately prevented from attending the meeting. The Chairman stated that MUDALIYAR RAJAPAKSE had carried out some interesting experiments on this subject. MR. BAMBER referred to the careful experiments made by MUDALIYAR RAJAPAKSE on the preservation of coconuts by storing them under different conditions. Nuts stored in the open lost their water in 9 months, and all germinated between the seventh and ninth month. The nuts kept in a dry store lost their water in six months and were all sound at the end of twelve months. He also stated that in storing nuts care would have to be taken that no heating took place by over-heaping and that the husk should be perfectly dry before storing. MUDALIYAR RAJAPAKSE then gave details of his experiments together with figures, which showed that nuts could be preserved for a longer period if stored under shade in a dry place. The Mudaliyar undertook to carry on a further experiment of storing nuts on a larger scale. The Chairman said that the results were valuable and would be published in the TROPICAL AGRICULTURIST. He thought that the Committee was indebted to MUDALIYAR RAJAPAKSE for his interesting figures. MR. SINCLAIR stated that MR. MARTIN has also made some experiments and he had also received some information as to the storage of nuts for long periods on the Malabar Coast.

4. *The best Way of Cultivating Coconut land without the help of Cattle which are difficult to obtain and still more difficult to upkeep.*—The Chairman stated that the nature of the information desired by MR. MARTIN, who brought up this question on the agenda was not known. He proposed postponing discussion of the question to the next meeting, and stated that he would write to MR. MARTIN asking for further information.

5. *The New Coconut Disease.*—The Chairman stated that MR. PETCH would give to the meeting the latest information as to this disease. The Botanist and Mycologist stated that the Officer lent to the Plant Pest Board of Kurunegala, as Inspector, has inspected the Gannawa, Weuda and Madure Korales. In Gannawa Korale, diseased trees were found in four villages, on 9 properties : nut fall was observed in four cases. In Weuda Korale, diseased trees were found in 5 villages, on 6 properties : chiefly leaf droop : nut fall observed in four cases. No disease was noted in Madure Korale.

The Agricultural Instructor of the North-Western Province had inspected villages in Hiriyala Hatpattu, and reported that he had practically found no disease.

On the road from Delwita to Kurunegala, the inspector has found the disease on 14 estates, with nut fall in 11 cases. On the road from Weuda to Kurunegala, 16 estates have been inspected, all but 2 of which were affected. One estate was visited on the Dambul Road. No leaf droop was noticed, but nut fall from one tree. On the Puttalam Road, the disease was found on four properties—nut fall on three of them. In Kurunegala, the disease has been recorded on two estates—nut fall being very bad in one case. MR. PATTERSON exhibited specimens of diseased leaves and nuts and said that the disease

could be found on many properties. He had seen it, he thought, in several districts but at the present time the amount of nut fall was not serious. MR. T. Y. WRIGHT asked for information as to how the inspectors did their work, he had had one case reported to him which he thought should be investigated. The Chairman said that in this instance the inspector had been placed at the disposal of the Plant Pest Board of Kurunegala, and he would enquire into the case brought to his notice by MR. WRIGHT. The disease could be found spread over a fairly large area but it did not appear at the present time to be doing much damage. MR. LONG-PRICE stated that he thought the disease was not a new one and he had not as yet seen very much damage occasioned by it. MR. PATTERSON emphasized the importance of not overlooking the existence of this disease.

6. *Proposals submitted to Government in regard to the Co-ordination and Extension of the Agricultural Services of the Colony.*—The Director of Agriculture stated that the next matter on the Agenda was the consideration of proposals submitted to Government in regard to the co-ordination and extension of the Agricultural Services and that he had invited MR. H. STOREY, as the only member of the Technical Committee of the Rubber Research not a member of the Committee of Agricultural Experiments, to be present. He said that Government had placed these proposals before the Legislative Council and was inviting the opinions of the various agricultural bodies as to their suitability to the requirements of the Colony. He gave a brief summary of the proposals, which had been in the hands of members of the Committee for some weeks and invited a general discussion upon them. He said that those proposals had been submitted to Government after he had had only seven months experience in the Colony, but they were based not only upon experience gained in various other tropical Colonies of the Empire but also upon careful investigations made personally during circuits through various districts of the Colony. He had now visited the main agricultural districts and he was convinced that there was ample scope for an enormous amount of work by an Agricultural Department. He took it, that the duties of an Agricultural Department in a Colony, such as Ceylon, necessitated adequate provision being made for the protection of existing agricultural crops against losses from pests and diseases, for researches into existing agricultural practices and for experiments to test where improvements can be effected. There were not only the existing main crops to consider but the possibilities of new ones to be considered. It is, he thought, possible that the Colony could produce its own requirements of sugar instead of introducing 25,000 to 30,000 tons at a cost of several millions of rupees. The possibilities of the cultivation of fibres in the dry zone, of limes for the manufacture of citric acid and of cotton in the Hambantota district deserved close investigation. All these industries can be industries of small cultivators, but experience in other parts of the tropics showed that progress in new industries was very slow unless assistance was given in the shape of scientific advice, of machinery and factories on a co-operative basis, or of concessions or pecuniary assistance. But it was not in connection with possible new industries that

the first work was required. There were over 2½ million acres in the Colony under cultivation at the present time and yet the imports of cattle, goats and sheep ran nearly into 6 figures, the value of rice, potato, curry stuffs imports was 50 to 60 million rupees, of butter and ghee over Rs. 600,000 and of organic manures such as castor and groundnut cakes of a value of nearly Rs. 4 millions. It was unnecessary for him to follow the usual time-worn arguments as to Ceylon being essentially an Agricultural country nor to emphasize that 64% of the total population of the Colony depended upon agriculture and pasturage. The agriculture of the villager required very careful investigation and was capable of considerable improvement and extension. The question of agricultural education was a most important one and necessitated that agricultural training should be made available for prospective landowners and superintendents of estates, for village headmen, for teachers in rural schools and for the smaller cultivators. The schemes now submitted may be defined as being designed to meet Research and Education, and it was unnecessary for him before this Committee to urge the advantages of Research and Education in agricultural matters.

It had been stated in some quarters that the scheme as submitted was a somewhat ambitious one. It might appear to be ambitious in the light of past provision for agriculture, but he would ask members to consider the expenditure on agriculture in other purely agricultural countries and also to remember that the proposals now before the meeting would take some time to bring into force and that during that time there was every reason to believe that the Colony would progress at a rate not behind the rate of progress during the past few years. Evidence gathered since the proposals were written appeared to indicate that they were along lines suited to the conditions of the Colony and it was pleasing to find that they were receiving support from members of all classes of the community. He had received various letters since the Sessional Paper appeared from Planters, Government Headmen and from Government Officers. A letter from the Assistant Government Agent, Puttalam, who is a member of this Committee, was read in which it was stated that he thought the "Provincial" system was the correct one as "the needs, conditions and capabilities of the various provinces are so varied. In no other way is it possible to consider fully and to develop the needs of each or to reach and educate the cultivators in each district." A telegram from MR. N. J. MARTIN strongly supporting the proposals was also read.

Reference to the proposals showed that the appointment of an Economic Botanist had been urged. This has in principle since been independently placed before the Secretary of State for the Colonies by the Rubber Growers' Association and others interested in the question of seed selection in Hevea. The appointment of an additional Mycologist for rubber is asked for. This has been urged for on the motion of the Haputale Planters' Association within the past few months. The establishment of an inspectorate force for plant pests and diseases has already been discussed in detail by this Committee and Government has indicated its approval of such appointments and has authorized provision to be made for training sub-inspectors from October

next. The proposals for the establishment of an agricultural school and experiment station, with agricultural assistants in various districts of the Northern division has with some small amendments met with the unanimous support of a Committee of the Board of Agriculture appointed at the instance of Government, and there are outstanding requests at the present time for Agricultural Instructors for the Trincomalee and Matale districts.

These instances are of the greatest encouragement to the Department and it emphasizes the fact that more men and more money must be made available to the Department if it is to be adequately equipped to meet the demands that agriculturists and agricultural industries will and should make upon it.

But of course the question of cost was the main difficulty. He felt that Government would be prepared to meet the annual recurring cost if agriculturists supported the proposals, and he was certain that if agriculturists could in any way indicate that they really needed early provision for the proposals and would collect some money to meet some part of the capital costs, that the proposals would be carried out completely within say the next 5 or 6 years. The agriculturists of other Colonies had devised means for raising money for agricultural research when the Government did not feel able to meet all their requirements from General Revenue, and here in Ceylon we have previous instances of the same principle, viz., the employment of Mycologists by the Planters' Association and within recent years the Rubber Research Scheme contributions for researches in rubber chemistry.

Another question to which the Director invited particular attention was the amalgamation on the score of better efficiency of the Agricultural Society and the Agricultural Department and of the various Committees now dealing with agricultural matters. He thought a strong Central Committee to be known as the Board of Agriculture with sub-committees would be advisable. Such organizations would be not only of great assistance to the Department but would no doubt eventually be consulted by Government on all matters affecting the agricultural development and welfare of the Colony.

Questions had been raised in some quarters as to the employment of members of the permanent population of the Colony in the superior posts of the Department. This matter has been already dealt with in the Legislative Council by the Hon'ble the Colonial Secretary when it was stated that Government would be prepared to make these appointments from members of the permanent population of the Colony if applicants with the required scientific knowledge and training were forthcoming. His personal view was that the agricultural service should be made sufficiently attractive, so as to encourage the best of the science students of the Colony's secondary schools to take up agriculture as a profession, and he would welcome any efforts that might be made to teach agricultural science in those secondary schools. Some officers would have to be recruited from abroad and provision would have to be made for the training of officers for the Department in the Colony, in India, and possibly further afield.

The decision of Government on the proposals could only be expected when the degree of support by agriculturists—for whom the proposals had been outlined—had been ascertained.

The HON'BLE MR. R. HUYSHE ELIOT in proposing a hearty vote of thanks to the Chairman stated that the planting community owed a debt of gratitude to the Chairman for what he had done during the short period of 12 months he had been in the Island. He stated that the attention of the Chairman for greater assistance to agriculture had been drawn by members of this Committee soon after his arrival and he thought the proposals now submitted had been carefully thought out and would be supported by all interested in the agricultural progress of the Colony. If the money could be found the proposals would tend to place the Department on a good footing.

MR. T. Y. WRIGHT commended the proposals re Provincial Councils, and stated that there should be no difficulty in forming these Committees at once.

MR. GOLLEDGE asked whether the suggestion that some of the export taxes might be earmarked for agricultural services referred to the existing taxes—to which the Chairman replied in the affirmative.

The HON'BLE MR. R. HUYSHE ELIOT asked for details concerning the suggestion that some of the costs, say of agricultural schools, and demonstration plots could be borne from local funds and not from general revenue.

The CHAIRMAN gave details of the existing arrangements in regard to some of the demonstration gardens at present being carried on by the Agricultural Society and local authorities.

Mr. GRAEME SINCLAIR asked for particulars as to the proposed duties of plant pest and disease inspectors and thought that some agriculturists would wish that means could be found to allow appeals. He thought that the Provincial Councils might be the bodies to whom appeals would be submitted. A general discussion on this question took place and MR. SINCLAIR stated that he would bring the question up in fuller details at a subsequent meeting.

MR. GRAEME SINCLAIR proposed and MR. J. S. PATTERSON seconded, the following resolution, which was carried unanimously:—"That the proposals submitted to Government in regard to the co-ordination and extension of the Agricultural Services of the Colony meet with the approval of and are strongly supported by this Committee."

MR. GARRICK then proposed the following resolution, which was seconded by MR. R. G. COOMBE and carried unanimously:—"That this Committee considers it desirable that Government should inaugurate a scheme for the provision of a system of scholarships in connection with the training of suitable individuals to fill appointments in the higher grades of Agricultural Research."

The meeting terminated with a vote of thanks to the chair, and the members afterwards inspected the Experimental plots of tea.

PROGRESS REPORTS OF THE EXPERIMENT STATIONS.

From 1st November, 1917, to 31st January, 1918.

PERADENIYA.

TEA.

1. The yield for the month of November was 3,815 lb. green leaf, for December 4,113 lb. from 11 acres and for January 3,189 lb. from 6 acres. The September and October made tea fetched in Colombo 52 cents per lb. for Broken Orange Pekoe, and an average of 38 cents for all grades.

2. The total output of green leaf for 1917 is 42,835 lb. from 11 acres, of which 6 acres were pruned in June.

3. Plot 149 (Manipuri Indigenous) planted with dadaps has given the highest yield, 6,761 lb. green leaf, equal to 1,632 lb. made tea per acre per year.

4. Plots 146—150 were pruned in January leaving a live branch to carry the bushes through the dry weather.

5. An increase of Shot-hole borer has taken place, the bushes in the upper portion bordering the jungle being more heavily affected than formerly In plot 149 there were 178 bushes affected and in plot 150, 392.

6. The newly cleared two acres of land have been planted with stumps from Huldubari Dooars seed. The stumps were shaded with ferns and the majority are coming on well. One acre has been planted with Dadap cuttings 16 ft. × 16 ft. and the other with Gliricidia. The two plots were interplanted with Sword bean (1 seed being put in the centre of 4 stumps) as a green manure.

7. The remaining 4 acres of jungle between the tea and Hill Top rubber is being cleared for extending experiments with Tea.

8. In the year 1917, the dadaps in plot 144 were pruned three times, yielding 10,053 lb. of mulch. In plot 149 the dadaps were cut three times, yielding 8,693 lb. of mulch.

9. The Albizzias in plot 150 were pruned once yielding 8,762 lb. of mulch.

10. Goipani Hybrid Tea seeds received from Assam have been put out in nurseries. The percentage of germination is satisfactory.

RUBBER.

11. The two young plantations have been supplied with stumps from our own nurseries.

12. Plots 11, 12 and 13 have been planted out with Cajanus Indicus (Dhall) 5 ft. × 5 ft. The plants are all coming up well.

13. The following new experiments have been started in January on plot 80c. which was resting :—

(a) The 10 trees previously tapped by a single cut are now being tapped by a single V.

(b) and the 10 trees previously tapped by a V are now being tapped by a single cut to the left.

14. The work of putting up short contour walls on the hill side rubber plantation has been completed.

15. All old stumps in the rubber plantations have been uprooted.

16. The yields of tapping and manurial experiments for 1917 have been worked up for presentation to the meeting to be held in March.

CACAO.

17. Two rounds of picking have been completed since the last meeting. A very fair crop was gathered. The autumn crop is a satisfactory one.

18. The total for the year 1917 from all the plots was 18,080 lb. of dried cacao.

19. The old cacao is being thoroughly pruned and cut back. It had become too dense and heavy.

20. 263 cwt. of cacao have been sent for sale in Colombo, the top price realised being Rs. 37 per cwt.

21. All the leguminous plants, except dadaps and gliricidia, were uprooted in plots 68—76a (young cacao), as they had become too thick.

22. The artificial manures necessary for manuring the cacao experiment plots have been ordered and will be applied as usual in February. Potash from burnt coconut shells will be substituted for Sulphate of Potash, which is not procurable.

COCONUTS.

23. The price realised for coconuts at the last sale by auction in November was Rs. 15 per 1,000 good nuts, this being the lowest rate so far obtained.

24. The 10 acre plot of coconuts has been ploughed,

25. Several trees attacked by Red-weevil (*Rhynchophorus ferrugineus* have been treated.

COFFEE.

26. The dadaps and *Leucaena glauca* shade over the coffee has been pruned and mulched round the plants.

27. All the varieties have been topped and pruned.

28. The total quantity of Robusta berries picked and sold during the year was 249½ lb. from ½ an acre, as against 192½ lb. in the previous year.

The total quantity of hybrid berries picked and sold during the year was 393⅞ lb. from ¼ of an acre, as against 351 lb. in the previous year.

29. The different strains of coffee received from numbered trees on the Experiment Station of the Department of Agriculture, Java, are doing exceptionally well, and will be ready for planting out in the South-west monsoon.

PADDY.

30. Of the 14 varieties of paddy sown in nurseries on 29th September and transplanted on 8th October, three have proved unsuitable to the district. Most of the plots are in ear and some of them will be ready for harvesting in a fortnight's time.

31. A selection of plants from the best varieties has been made, for seed purposes for the next crop. Two strains of paddy from Mauritius were sown, but were not a success as the seeds did not germinate well.

VANILLA.

32. The vanilla pods are being harvested and cured. There is every promise of the crop exceeding that of last year.

FOOD PRODUCTS AND CURRY STUFFS.

33. Two acres of land have been planted with the following crops :—Dhall, grams, beans, (sword, French, Lima and cow peas), aniseed, fennel, fenugreek, mustard, garlic, coriander, cummins (Sudu duru and Maha duru), chillies, and onions (acclimatised, giant red country, and giant Spanish). The seeds have all germinated well.

VEGETABLES.

34. The following English and local vegetable seeds have been planted out in the fruit plots :—Beetroot, carrot, lettuce, tomatos, celery, brinjals, chillies, gourds, yams, pumpkins and cucumbers.

SHOW PLOTS.

35. New beds have been planted with the following green manures :—Crotalaria muijussi, C. alata, C. incana, C. striata, C. verrucosa, Indigofera suffruticosa, I. longaracemosa, I. arrecta, I. hirsuta, Tephrosia Hookeriana, T. vogelii, T. villosa, T. candida, Trifolium resupinatum, Cassia tera, Mauritius sword bean, Florida Beggar weed and Desmodium sp.

GENERAL.

36. The river bank by the ferry has been planted with Teosinte (Euchlaena) (Reana) (luxurians). This is a highly valuable forage plant and yields an immense crop of excellent fodder. It is excellent food for cows. The plants are making vigorous growth.

37. The plot of Indigofera arrecta has been uprooted having run its course. The seed is still being threshed.

The land is being ploughed and got ready for planting sweet potato varieties from Mauritius.

38. A further consignment of different varieties of maniocs received from Mauritius have been planted out in the nurseries. Most of these have come up well.

Plots of different varieties of sugar cane and maniocs have been established.

39. All the castor plants growing on the Station have again been uprooted and burnt.

40. All the old stumps on the Station, excepting a few very large ones, have been removed,

41. Steps have been taken to clear up and open an old abandoned road above the tea plots to meet the road on the Hill Top rubber.

VISITORS.

42. 52 visitors have been shown round the Station since the last report.

RAINFALL.

43.

November	16·49 inches	...	rainy days	... 18
December	... 6·49 ,,	...	,,	... 13
January, 1918	... 4·53 ,,	...	,,	.. 13

ANURADHAPURA.

1. The Director of Agriculture and the Acting Secretary, Ceylon Agricultural Society, inspected the station on the 30th January, 1918. The Manager has made three visits since the last report.

2. *Paddy.* The different varieties of paddy mentioned in the last report were transplanted in the fields. Single plants were put out at a distance of 6 inches apart. All the varieties are showing a remarkably vigorous growth, and stooling very well. There are a few poor patches on land where the levelling necessitated the removal of the surface soil to fill in the lower portions. These will receive special attention before the next crop is planted and will recover with cultivation and manuring.

3. The Hatial and Maccan Pina paddy are in flower, two months after transplanting.

4. The area reserved for Mauritius Hemp has been clean weeded and sown w.th Dhall (Cajanus Indicus). Plants of Mauritius Hemp procured from Balangoda are being planted out 5 × 5 feet.

5. The jungle along the main road to Jaffna up to the Railway line has been felled and burnt. Estate labour being not sufficient to push on the work, it is proposed to give out the rest of the jungle on contract, the work to be completed by the end of March, the latest.

6. The different Food products and curry stuffs detailed in the Director's report in September have been planted out. The abnormally heavy rainfall in January has, without exception, adversely affected all the crops. Many have died out completely.

The plots are being ploughed, and will be resown within a few days.

7. The old tea plot has been planted with 500 Betel cuttings from Jaffna.

8. Vacancies in the 3 acre plot of coconuts planted in December, 1916, have all been supplied. The land has been discharrowed and sown with Lima beans.

9. A plot of four varieties of plantains—Suvandal, Alukehel, Hondarawalu, and Kolikuttu, have been planted out.

10. A plot of lime plants raised in Peradeniya from seed received from British Guiana has been added to the Citrus plots. All plants have been well forked round with cattle manure and mulched.

11. All drains have been deepened, but even now many of the plot have suffered by flooding in the continuous showers experienced in December and January, the resulting stagnant water killing the crops.

12. All cooly lines, the store and cattle shed have been rethatched with cadjans obtained foom Mahailuppalama.

MAHAILUPPALAMA.

13. *Coconuts.* The fifth crop for the year 1917 was picked in November. The number of nuts picked during the year was 36,042 an increase of 7,811 nuts over last year, from an area of 23½ acres—composed of plot A, 17 acres of 9½ year old palms, and Plot B, 6½ acres of 10½ year old palms (number of trees per acre 70).

14. All the trees in the unirrigable plots were weeded round and the soil loosened within a radius of 6 feet from the stem. Mimosa weed has been uprooted and burnt.

15. A part of the nine acres of paddy land, which had been left fallow since 1914, was prepared and planted with the following varieties of chillies :—Nagpur round and long, American round and ordinary Jaffna chillies. A large proportion of the plants have been eaten by stray cattle.

Government have decided that the Station should be offered on a ticket of occupancy and arrangements are being made for the transfer of all machinery, tools and live stock, and to dispose of all produce in stock.

H. A. DEUTROM,
Acting Manager Experiment Station.

PROPOSED EXPERIMENT STATIONS, ETC., FOR THE NORTHERN PROVINCE.

REPORT OF THE COMMITTEE.

This Committee was appointed at the request of Government on the motion of the Director of Agriculture seconded by SIR P. ARUNACHALAM at the meeting of the Board of Agriculture held on 26th November, 1917, to investigate the question of establishing Experiment and Demonstration Stations in the Northern Province.

It has held two meetings, the minutes of which are attached, and has inspected lands around Jaffna that might be suitable for a main experiment station.

The Committee is of opinion that early attention should be given to the investigation of agricultural problems and supports the proposals for the establishment of experiment and demonstration stations. It is convinced that agricultural development is only likely to take place as the result of research, education and demonstration.

The general proposals of the Director of Agriculture, as far as they relate to the Northern division of the Colony, have been discussed in detail. Although the Committee was only appointed to consider the Northern Province, it was thought that they might consider the suggestions made for those parts of the North of the Colony, viz., the North-Central Province and Trincomalee district of the Eastern Province included in the Northern agricultural division.

The Committee find themselves in agreement with these proposals with the addition of an agricultural assistant for the Trincomalee district and with such modifications of estimates as detailed in Annexure 11.

The following recommendations are made as the outcome of careful deliberations over these proposals :—

1. That a qualified scientific agriculturist be appointed with Head-quarters at Jaffna to have executive control over the agricultural and co-operative credit investigations and operations in the Northern division.

2. That a local assistant to this divisional officer be provided as soon as a suitably trained officer is available.

3. That an agricultural school be established in or near Jaffna sufficient for 30 students—provision to be made for 24 residents. To this should be attached an experiment station of from 25—30 acres in extent.

4. That the school be staffed with a trained farm school officer who shall be responsible for the education in the school and the general supervision of the experiment station and with an agricultural assistant mainly for the field works.

5. That trained agricultural assistants be provided for the Jaffna, Mannar, Mullaittivu and Trincomalee districts who shall be responsible for minor experiment stations and for agricultural demonstrations. These minor stations should be from 2—3 acres in extent and should deal with paddy and other crops of agricultural importance in the respective districts.

6. That the Anuradhapura Experiment Station should be developmental mainly on lines of testing possible agricultural development of the large uncultivated tracts of the North-Central Province,—and that any promising crops be grown on a sufficient scale to test their commercial possibilities.

7. That some provision should be made for advisory bodies, with a full knowledge of local agricultural methods and requirements, to assist the divisional agricultural officer and his staff.

The Committee desire to emphasize their well-considered opinion that only officers trained in agriculture should be appointed, that the salaries should be on a scale that will prove to be attractive to good men and that provision should be made by means of literature, lectures, short-courses at the school and by demonstration to encourage cultivators to take an interest in agricultural development and improvement.

They also wish to emphasize that in their opinion one of the main problems of agriculture of the Jaffna peninsula is centred around well irrigation and desire that early investigation be made in this branch of agricultural engineering.

(Signed) B. HORSBURGH
,, F. A. STOCKDALE
,, A. KANAGASABAI
,, P. RAMANATHAN
,, A. SABAPATHY
,, C. M. SINNAYAH
,, V. M. MUTTUKUMARU
,, V. CASIPILLAI
,, M. KELWAY BAMBER

ANNEXURES ATTACHED TO REPORT.

1. Minutes of Proceedings of Meetings.
2. Detailed estimate as amended and approved.

MINUTES OF PROCEEDINGS

of 1st Meeting of Committee appointed to consider the establishment of Experiment Stations, etc., in the Northern Province :—

First Meeting held at the Council Chamber at noon on December 20th, 1917.

Present:—MR. F. A. STOCKDALE, Director of Agriculture; MR. B. HORSBURGH, Government Agent, N.P.; SIR A. KANAGASABAI, Kt.; HON'BLE MR. P. RAMANATHAN, HON'BLE MR. A. SABAPATHY, MR. C. M. SINNAYAH, Gate Mudaliyar; MR. V. M. MUTTUKUMARU, Maniagar, Jaffna; MR. M. KELWAY BAMBER, Acting Secretary, Ceylon Agricultural Society.

At the request of members, the Director of Agriculture occupied the Chair.

The Chairman stated that at the Meeting of the Select Committee on the Supply Bill for 1917-1918, the question of establishing experimental agricultural stations in the Northern Province was discussed. It was decided to refer the whole question to a Committee of the Agricultural Society for report and at the last meeting of that Society this Committee had been appointed. He stated that he had in July last submitted to Government proposals for the general re-organization and correlation of the agricultural services of the Colony. These would shortly be submitted to the Legislature for consideration and would then be placed before the agriculturists of the Colony for discussion and elaboration. A brief review of those proposals was given and explanations made on various points in connection with the working of Co-operative Credit Societies, Experiment Stations and Demonstration Plots, the relationship of the Agricultural Society with the Department, and of the work of the Agricultural Instructors.

The proposals as relating to the Northern agricultural division were explained in detail. It was stated that what seemed to be indicated was a central experiment station in Jaffna to which could be attached an agricultural school, a small experiment station for paddy, and demonstration plots scattered throughout the Province. It was stated that it was thought that the Experiment Station at Anuradhapura should be a developmental station with a view to testing whether crops suited to the large tracts of undeveloped land in the Dry Zone could not be grown with commercial success while the proposed Experiment Station at Jaffna would be used for researches into the cultivations carried on in the Northern part of the Colony. It was felt that much more work should be done for agriculture. The people of the country were desirous of information and instruction in agricultural methods, but that it was useless attempting to teach until actual research had provided the data on which such teaching should be based. The experience of India, which had been carrying out extensive research in tropical agriculture since 1904, could be drawn upon but this was not sufficient and adequate provision for agricultural research within the Colony was most desirable.

The HON'BLE MR. P. RAMANATHAN and the HON'BLE MR. A. SABAPATHY asked various questions regarding the general proposals and the working of the proposed experiment station and school. They both thought that further agricultural work was required in the Northern Province, and indicated

various problems that required to be worked at. The HON'BLE MR. RAMANATHAN stated that he particularly desired to see agricultural education begun and made various enquiries as to the work being carried on at the School of Tropical Agriculture at Peradeniya. The HON'BLE MR. SABAPATHY stated that if the number of applicants was in excess of the accommodation available he thought that a preliminary entrance examination should be instituted, and that the Peradeniya rule with regard to candidates having passed the 8th standard should not be too rigorously enforced in the case of Jaffna. It was suggested that arrangements should be made for short Courses in the vernacular.

The Government Agent, N.P. stated that he was in entire sympathy with the desire to see an agricultural school and experiment station established in Jaffna, and he thought the benefit of such an establishment would be considerable in the Province. He thought that every endeavour should be made to obtain the best men possible for the various posts and that it was most essential that only fully trained men should be employed.

The HON'BLE MR. RAMANATHAN asked details of the work of the present Agricultural Instructor in Jaffna and of the work of other instructors throughout the Colony.

The question of costs was then gone into and the possible location for the Experiment Station and School was discussed.

In considering the proposals regarding a small station for paddy experiments, a letter was read from MR. V. CASIPILLAI, who was unavoidably absent from the meeting. This letter is annexed.

The Director of Agriculture undertook to consider carefully the discussion on the estimates of costs and to submit detailed estimates for the consideration of the Committee at its next meeting which it was proposed to hold at the Kachcheri, Jaffna, on Monday January 28th, 1918, to be followed on Tuesday January 29th by visits to the Tobacco Trial Ground and to lands which might be selected for the proposed Experiment Station. The meeting then adjourned.

(Confirmed at meeting held on January 28th.)

B. HORSBURGH,

Government Agent, N.P., *Chairman.*

COPY.

From V. CASIPILLAI, Jaffna.

To the Secretary, Ceylon Agricultural Society, Peradeniya.

Jaffna, 18th December, 1917.

Sir,

With reference to your circular, No. 4731 of the 29th November, 1917, I have the honour to inform you that I am willing to serve on the Committee but I much regret to say that I am unable to attend the meeting of the 20th instant, as I am laid up with a sore foot.

2. I do not know what the agenda for the date would be, and if the question of selecting a site for the experimental station in Jaffna is to be discussed, I beg to offer the following suggestions :—

(a) Having regard to the nature of the soils in Jaffna and the facilities for irrigation (for which only wells are available) it is necessary that there should be two stations, one of which should be for fruit trees and garden produce and the other for paddy. Very good garden lands, which are to be found at Maviddapuram, Alaveddy, Kantharodai, Ilevalai, and Chandilippay, cannot be acquired except at high prices, it being necessary to pay as much as from Rs. 1,000/- to Rs. 1,600/- per acre, and even then, I doubt if a large area in one block can be purchased. As we must acquire at least 10 acres, the above rate of value will be prohibitive. The next best land can be found on the East or South of the Ramanathan College at Enivil where lands are cheaper than in the aforesaid villages.

(b) The land for cultivation of paddy must be low land, as the cultivator will have to depend on rain only, there being no means of irrigation. There are very good paddy lands at Alaveddy, Kantharodai and Chandilippay, but an acre of land in these places will cost not less than Rs. 2,000 and therefore we will have to go elsewhere. Very good paddy lands can be bought at Pooneryn where the price per acre will range from Rs. 100 to Rs. 150. As against this, there is the difficulty of access to Pooneryn lands from Jaffna Town. One will have to cross the Jaffna lagoon by boat and then travel by cart to the land which may be about two miles distant from Pooneryn Fort. In favourable weather the lagoon can be crossed in about three hours but when the weather is adverse it will take from six to ten hours. Failing Pooneryn (where, by the way, a large block can be easily acquired) the next place will be Navatkuly or Maravampulo which are about six miles from Jaffna and where paddy lands can be bought for between Rs. 500 and Rs. 600 per acre.

I will suggest the village of Copay also which is about five miles from the town and where we can get paddy lands (not very good) for about Rs. 300 per acre. If land for paddy can be secured at Copay, the garden land also may be secured close to it, so that supervision of both would be easy. Good garden lands may be bought here close to the paddy lands.

3. I thought of suggesting that each chief Headman should be in charge of an experiment plot of land in his village in which products suitable to the place may be raised and demonstrated to the villagers. But in view of the comprehensive nature of the scheme put forward by the Director of Agriculture as stated in his confidential communication, my suggestion may stand over for the present.

If the Committee approves, the consideration of the acquisition of sites may be postponed till after the next meeting proposed to be held in Jaffna.

I am, Sir,
Your Obedient Servant,
(Sgd.) V. CASIPILLAI.

MINUTES OF PROCEEDINGS

of 2nd Meeting of Committee appointed to consider the establishment of Experiment Stations, etc., in the Northern Provinces :—

Second Meeting held at Kachcheri, Jaffna, at 2 P.M., on January 28th. 1918.

Present:—MR. HORSBURGH, Government Agent, N.P., in the Chair: MR. F. A. STOCKDALE, Director of Agriculture; SIR A. KANAGASABAI, Kt.; HON'BLE MR. P. RAMANATHAN; HON'BLE MR. A. SABAPATHY; MR. C. M. SINNAYAH, Gate Mudaliyar; Mr. V. M. MUTTUKUMARU, Maniagar, Jaffna; MR. M. KELWAY-BAMBER, Acting Secretary, Ceylon Agricultural Society.

A letter was read from MR. V. CASIPILLAI, Proctor, S.C., regretting his inability to attend owing to illness. The Committee desired to convey to MR. CASIPILLAI their regret at his inability to attend the meeting.

The minutes of the first meeting of the Committee which had been circulated amongst members were after amendment confirmed.

The estimates of expenses for a proposed agricultural establishment for the Northern division of the Colony as submitted by the Director of Agriculture were next considered. The Director of Agriculture explained that these estimates were not confined entirely to the Northern Province but included establishment for the North-Central Province and the Trincomalee district of the Eastern Province to comprise the Northern Agricultural Division as outlined in Sessional Paper 1 of 1918 which was now before all members. The estimates for buildings were subject to revision by the Public Works Department.

The estimates were then gone through in detail. The HON'BLE MR. RAMANATHAN asked for particulars of the Farm School officer and suggested that the salary for this post which he considered was a most important one in the proposals, should be carried out at Rs. 1,800 to Rs. 2,400. He stated that this officer would have responsible duties in respect of agricultural education in the Province and of the supervision of the Experiment Station attached to the proposed agricultural school. He thought that the agricultural services should provide salaries which were adequate to attract capable men.

The DIRECTOR OF AGRICULTURE stated that he was glad that the HON'BLE MR. RAMANATHAN had raised this question, as he thought that these Farm School officers should hold good positions in the scheme for trained men and he thought that by grading the assistants for research officers at Headquarters that the salaries from the Farm School officers could be raised to the salary asked for without additional cost for the whole of the proposals. The raising of the salary to Rs. 1,800-2,400 was unanimously agreed to, and that of the Manager, Anuradhapura Experiment Station, placed on a minimum of Rs. 1,500/- in place of Rs 1,320/. The estimate for labour and upkeep of main Experiment Station was discussed in detail on the instance of the Director of Agriculture and raised from Rs. 10,000 to Rs. 12,000 for 1918-19 and from Rs. 15,000 to Rs. 17,500 as the ultimate expenditure. With these modifications and after discussion on the item for lines for labourers raised by the HON'BLE MR. SABAPATHY the estimates submitted were adopted.

The appointment of Assistant to the Divisional Officer was dealt with. The question of obtaining a suitable officer from India was raised but the

unanimous opinion was that provision should be made for training a local man for the post. It was pointed out that this appointment would not be essential from the outset and that it was essential that it should be filled by an officer who had a good training in scientific agriculture.

Finally, on the motion of the HON'BLE MR. RAMANATHAN and seconded by the HON'BLE MR. SABAPATHY the following motion was unanimously adopted by the Committee :—

"That this Committee appointed by the Board of Agriculture having considered the estimates of expenditure for the agricultural scheme for the Northern Division submitted by the Director of Agriculture is of opinion that the various items of personal emoluments and other charges shown therein are necessary, that the provision for costs, as amended, is also necessary, and that within the figures shown for the total expenditure the Committee recommends that the Board of Agriculture approve the draft scheme."

The Director of Agriculture raised the question as to whether any funds could be raised locally to meet some part of the capital expenditure, but the Committee thought that this would not be possible nor could it be looked for.

The meeting adjourned for an inspection of likely sites for the Experiment Station and School on the 29th and for the consideration of the Report.

(Confirmed at meeting held on January 29th.)

B. HORSBURGH,
Government Agent, N.P.,
Chairman.

ESTIMATE OF EXPENSES—NORTHERN DIVISION.

As amended and approved at Meeting held on January 28th, 1918.

FULL STAFF.

Personal Emoluments.			*1918-19*	*Ultimate.*
Divisional Agricultural Officer		£400—700	7,500	10,500
Assistant ,, ,,		Rs. 2,400—3,000		3,000
Clerical Assistants	2	,, 600—1,200		
		,, 600— 780	1,200	1,980
Farm School Officer		,, 1,800—2,400	1,800	2,400
Manager, Expt. Station, A'pura		,, 1,500—1,800	1,500	1,800
Agric. Assistant, Farm Jaffna		,, 1,020—1,200	1,020	1,200
Agric. Assts. (4 not 3)	Jaffna, Mannar, Mullaittivu, Trincomalee	780— 960	2,340 (3)	3,840 (4)
Conductors (5 possibly 6)		,, 300— 600	1,200 (4)	3,600
Agric. Demonstrators (5 ultimately 10)		Rs. 240—300		3,000
			16,560	31,320
Peons	Head Office 1, Farm School 1, Anuradhapura 1	Rs. 180—240	540	720
			17,100	32,040

	1918-19.	Ultimate.
Personal Emoluments (brought forward)	Rs. 17,100	Rs. 32,040
Other Charges. *Annually Recurrent.*		
Labour and Upkeep of Main Expt. Stations	12,000	17,500
,, ,, Minor Stations and Demonstration Plots	2,000	5,000
Upkeep of School		1,000
Labour and Upkeep of School Gardens	500	750
Co-operative Credit Societies	200	200
Incidentals	300	550
Travelling	5,000	7,000
	20,000	32,000

Capital Outlay.

Experimental Station, Jaffna, Acquisition of land 30 acres ...	Rs. 30,000	
School and Farm Buildings, Jaffna	,, 30,000	Building estimates subject to revision by Public Works Department.
Buildings-Anuradhapura	,, 5,000	
Residences { 1. Farm School Officer, Jaffna; 2. Agric. Assist. Farm, Jaffna; 3. Manager, Expt. Stn., A'pura }	17,000	
Lines for labourers Jaffna and Anuradhapura	10,000	
Acquisition of land for paddy experiments	1,000	
Engine, Silo, Dipping tank, etc.	7,000	
	100,000	

Annually Recurrent on Buildings	
Repairs	1,000
Improvements and Additions	2,000
	3,000

Recapitulation.

	1918-19.	Additional.	Ultimate.
Capital Outlay ...	75,000	25,000	100,000
Personal Emoluments ...	17,100	14,940	32,040
Other Charges ...	20,000	12,000	32,000
Repairs and Improvements		3,000	3,000
	112,100	42,940	167,040

The above report and its annexures were considered by the Board of Agriculture held at Colombo on February 25th, when it was decided on the motion of the Director of Agriculture, seconded by MR. G. A. JOSEPH, that the report should be submitted to Government with the recommendation that it should receive favourable consideration,

THE CEYLON AGRICULTURAL SOCIETY.

PROGRESS REPORT No. LXXIV.

MEETINGS.

The last meeting of the Board was held in Colombo on 26th November last at the Council Chamber and was presided over by the Hon. the Colonial Secretary. There was a good attendance at this meeting, and an interesting discussion on the Land Development Committee's Report took place.

MEMBERSHIP.

The following members have joined since the last meeting ;—Administrator, Northern Territory of Australia, Darwin ; JONATHAN M. P. W, GUNAWARDENA ; RUNAR OLSSON-SEFFER, Calcutta ; P. G. BOILLAU ; H. C. BUTLER, F.M.S., Superintendent, Alauwa Estate ; W. MURRAY, W. ALFRED SILVA, T. AMARASURIYA, DR. F. ALLES, T. OZAKI, Johore; M. B. PAGE & Co., U. S. A.; FRED. S. ELSON; MRS. GRACE M. BROMLEY, F. E. PATTISON, DIRECTOR, Central Rubber Station, Buitenzorg; KENNETH MORFORD, R. VAN STARREX, R. L. PEREIRA, W. J. DE SILVA, M. SAMUEL MENDIS, Superintendent, Pelenda Estate, Agalawatte ; D. C. WICKREMASEKERA, T. W. P. CROWTHER, D. C. WIJEWARDENE, W. L. LLOYD, B. J. A. CARRIM ; G. P. GADDUM, RICHARD FERNANDO, B. JOHN MENDIS, ARTHUR ELLAWALA, M. YAMAMOTO, Taiwan, Japan ; TAIWAN-SOTOKUFU NOJISHIKENJO, Taiwan, Japan ; H. BENJAMIN, Talalla; and H. G. GREIG.

STAFF, INSPECTIONS, ETC.

The Secretary returned from leave and resumed duties on February 1st, relieving MR. KELWAY BAMBER, who acted for him.

The Organising Vice-President and Acting Secretary visited Kegalla, Hettipola, Anuradhapura, and the Northern Province.

The Agricultural Instructors were engaged in extensive travelling in connection with seed distribution, extended cultivation of food crops, plant pests inspection, etc.

PROPOSED DEVELOPMENT OF THE AGRICULTURAL DEPARTMENT.

The publication, as a Sessional Paper, of the Director of Agriculture's Scheme for the Extension and Co-ordination of the Agricultural Services of the Colony, deserves to be recorded here as an event of the greatest importance in our local agricultural history.

In his Scheme MR. STOCKDALE indicates what he considers necessary in the way of men and money for satisfactory direction of the agricultural affairs of the Island, and the opinion expressed by the Government as well as the public is favourable to the adoption of the Scheme.

Its chief feature is the apportionment of the Island into divisions for the purposes of provincial administration, which would appear to be as essential for the proper control of agricultural as of other Government departmental work.

The pioneer service rendered (under the greatest difficulties and disabilities) by this Society are duly acknowledged. Having laid the trails, the Society must now look to the Department to develop the broad highways.

INCREASING THE LOCAL FOOD SUPPLY.

The efforts made to extend the cultivation of food crops in the Colony were steadily maintained during the last cultivating season, with the result that this year's distribution of seeds, bulbs, cuttings, yams, paddy, etc., constitutes a record, the total quantity being far in excess of any previous distribution.

The demand for seeds, etc., from various quarters surpassed all anticipations, and judging from the quantities handled, the cultivation of food crops has been considerably increased.

The following details will afford an idea as to total quantities distributed up to end of December, 1917 :—

Total number of applications served 1,267
Value of seeds supplied to Government Departments ... Rs. 5,571·50

Government Departments.	Currystuffs. Rs.	c.	Vegetables. Rs.	c.
Government Agents and Assistant Government Agents ..	3,312	40	682	30
School Gardens ...	133	20	58	90
School Boys' Home Gardens ...	98	20	1,079	20
Co-operative Credit Societies' Gardens	88	00	119	30
	3,631	80	1,939	70

Varieties and Quantities distributed :—

Paddy	25	bushels
Potato (English)	1,000	lbs.
Yams (Dioscoreas and Tanias) ...	750	,,
Sweet potato	9,600	cuttings
Manioc	1,500	,,
Fruit plants	140	
Vegetable Seeds (Local and Foreign) ..	54,245	packets
Currystuffs and Foodstuffs ...	67,779	,,

Under the last head the varieties dealt with were :—

Dhall, Maize, Sorghum, Italian Millet, Bengal Gram, Green Gram, Black Gram, Horse Gram, Chillie, Lentil, Cow Pea, Turmeric, Onion, Garlic, Cumin, Coriander, Fenugreek, Mustard, Groundnut, Ginger, Anise, Fennel.

CURRYSTUFFS.

The growing of currystuffs was purely of the nature of an experiment, as the Island has hitherto depended mainly on India for its requirements which annually cost some Rs. 5,173,000. Anise, fennel, and fenugreek are known to grow in certain districts, but no one appears before now to have taken up their cultivation as regular crops. The Society's main object, therefore, in distributing these seeds was to discover which particular district would be most suitable for any given crop.

The Agricultural Instructor at Harasbedde reports that the following currystuffs did well at the places named :—

Variety.		*Place.*
Anise	...	Teripeha.
Fenugreek	...	Kumbalgamuwa and Nildandahena.
Chillie	...	Nildandahena, Walapane, and Uda Hewaheta.
Coriander	...	Kotmale, Uda Hewaheta, and Walapane. Coriander has done very well.
Fennel	...	Teripeha.
Turmeric	..	Kotmale and Maswela.
Ginger	...	Maswela and Ketakandura in Walapane.

THE LAND DEVELOPMENT SCHEME.

As was decided at the last meeting of the Board, the report of the C. A. S. Committee was submitted to Government, whose reply will be submitted to the Board to-day. The offer of Rs. 20,000 for making an immediate start with the Nachchaduwa Scheme should be gratifying news to all who are interested in the development of tank areas.

PADDY.

Perennial Rice.—Some seed of this variety, referred to in last Progress Report as having been introduced from Queensland, was secured by Agricultural Instructor, Nugawala, and has been distributed for propagation at the Experiment Station, Peradeniya, Government Stock Garden and at Jaffna.

Manuring Experiment at Galagama.—The Agricultural Instructor, Ratnapura, carried out an experiment with artificial manure supplied free of cost by the Colombo Commercial Co., Ltd. A field of approximately an acre was selected, with a control plot of the same extent, in Pelmadulla, belonging to Petiyagoda Korala. The preparation of the land was started on 15th April, 1917, and completed on 25th May, and the fertiliser applied on 30th May. Seed was sown broadcast on 15th June. The yield was 22 bushels, as compared with 10 under ordinary cultivation, The growth in the fertilised plot was luxuriant at the start, but the yield was not commensurate with the growth.

Caterpillar Pest in paddy was reported from Hinidum pattu in the early part of December, but heavy rain in a few days having flooded the affected fields they were rid of the pest without much damage.

Experiments in New Centres.—MR. KAPUWATTE stationed at Harasbedda reports that arrangements have been made for experiments in transplanting and seed selection at Boragolla, Teripeha, Kumbukewela, Kumbalgamuwa, Padiyapelella, and Maturata.

RICE HULLERS.

The huller imported from Calcutta having proved satisfactory, it was decided that the Society should have one set up at the Experiment Station for regular use, and accordingly a machine has been ordered. Two other machines have been ordered—one for REV. FR. STANISLAUS, and the other for MR. J. C. RATWATTE.

DEMONSTRATION AND EXPERIMENTAL GARDENS.

The *Hettipola* garden in charge of MR. NUGAWELA is carrying the following crops for the season :—(1) Lima bean, (2) black gram, (3) Bengal gram, (4) sword bean, (5) cowpea, (6) fenugreek, (7) cumin, (8) coriander, (9) chillies, (10) dhurra, (11) maize, (12) tanias, (13) manioc, (14) sweet potatos, (15) onions, (16) shallot, and (17) dhall. The latest report on above is (1) fairly good, (2) growing well—in pod, (3) very poor, (4) good—in pod, (5) very good growth, but poor in bearing, (6) bad, (7) fair growth—in flower, (8) unsatisfactory, (9) fairly good, (10) and (11) very good, but birds damage crop, (12) to (17) growing well.

The *Medagame* Garden in Uva carries crops of yams, cereals, legumes, currystuffs and foodstuffs, including sweet potatos, manioc, maize, millet, beans, gram, groundnut, dhall, green gram, cumin, anise, coriander, fenugreek, chillie, onions, and varieties of vegetables.

Harasbedde has been planted with chillie, anise, cumin, coriander, onion, ginger, cowpea, green gram, sword bean, Lima bean, dhall, kurakkan, Italian millet, dhurra, maize, horse gram, tanias, dioscorea yams, sweet potatos, manioc.

A new garden is being opened at *Godakewela*, in Ratnapura district, in addition to the *Balangoda* Garden, which has proved a great success. The new garden will be under the control of MR. L. A. D. Silva, Agricultural Instructor.

REPORTS.

The following is a report made by the Assistant Government Entomologist on Insect Pests attacking Paddy in the Galle district :—

" Paddy fields at Wakwella, Hagoda, and the lands in between these were inspected in company with the Agricultural Instructor, who had reported that the pest was spreading like fire and doing a deal of damage, particularly at Hagoda where the paddy was said by him to be totally destroyed. Difficulty was found in determining which of the numerous insects found in the fields was really responsible for the damage, but at last it appeared that the small Jessid Bug, *Nephotettix bipunctatus*, was the probable pest.

But little damage to the paddy plants was observed, except in a few small patches where all the plants were brown and no grain was ripening. The cultivators said that the recent rains had stopped the outbreak. In July, 1912, a similar outbreak took place in the Kalutara district, when 610 acres of paddy land were badly affected, and the monetary loss was estimated at Rs. 12.810. The pest mainly responsible for this damage was another small bug, *Nilaparavata Greeni*, but a considerable number of *Nephotettix bipunctatus* was also present.

Many Coccinellid beetles were observed in the affected areas at Wakwella. Specimens of these brought to Peradeniya have been observed to feed on specimens of *Nephotettix*, which were given to them, so there is little doubt that they are predatory on this bug and probably assisted in reducing the outbreak. The effect of the outbreak of *Nephotettix* differed from that of the "paddy fly" (*Leptocorisa varicornis*) in its localitised nature, and in the plants as a whole being injured; whereas paddy-fly only injures the ripening ears. The effect of *Nephotettix* on the latter is however very similar, the grains turning colourless and empty. *Leptocorisa* was present in the paddy fields examined, but in very small quantity.

As *Nephotettix bipunctatus* is well-known to fly to light on dark nights very readily, it is probable that future outbreaks may be prevented, or to some extent controlled, by the systematic uses of light traps. Experiments are being conducted with a view to ascertaining whether light traps are likely to prove effective, and the result of these will be reported later on.

LIVE STOCK.

A stud bull of a suitable size was procured from the Government Dairy and sent to Mannar, at the request of the Assistant Government Agent with a view to improving the breed of local cattle.

The Society's Kongayam stud bull is at present at the Experimental Station at Anuradhapura, and is available for service on application to the Resident Conductor.

AGRI-HORTICULTURAL SHOWS.

The following Shows have been arranged under the auspices of the Society: the local Co-operative Credit Society having organised them:—

Mawanella, February 25th and 26th.
Pinnawela, March 22nd and 23rd.

In connection with these the Society has offered the following prizes:—

Rs. 15 and Rs. 10 for the best, and second best School Garden in each Korale, Rs. 25 × 2 ...	Rs. 50·00
Rs. 10 and Rs. 5 for the first and second best Village Garden in each Korale, Rs. 15 × 2 ...	Rs. 30·00
Rs. 10 and 5 for the 1st and 2nd best Home Garden attached to each Registered School Garden, Beddewela, Pinnawela, Wakirigala, and Mawanella Rs. 15 × 4	Rs. 60·00

A Show is to be held on 16th and 17th March at Mawatagoda, in connection with which the Society has decided to give prizes up to Rs. 75.

Two Village Shows are likely to be held in Ruanwella and Yatiyantota in March, but no definite dates have been fixed.

A Village Show will probably be held at Dedigama by the local Co-operative Credit Society, of which details have yet to be settled.

COTTON.

A sample of Cotton grown at Kegalla was received from the Assistant Government Agent with a request for a report and valuation. On reference to the Spinning and Weaving Mills, Colombo, the Manager reported:—

"The cotton has nearly 1in. fine silky staple, and resembles American middling cotton except colour, as American cotton is pure white. The cotton, according to sample, is worth Rs. 60 per cwt."

The Director has characterised the cotton as of a fair length, rather harsh and somewhat discoloured—the latter defect probably due to wet weather at time of ripening.

The following is a report on a sample of Cambodia cotton raised at Ambalantota in the Hambantota district and submitted to the British Cotton Growing Association :—

" We have had the sample ginned here, and now give you copy of our expert's report and valuation on the same as follows :—'Good colour and grade, American style, staple 1 $\frac{1}{3}$, rather rough. Value 25*d.* on. Price of August Futures 18·40*d.*'

SEED AND PLANT EXCHANGES.

A quantity of pepper vine cuttings from the Experiment Station, Peradeniya, was distributed through the Agricultural Instructor, Northern Province, in Jaffna, Tenmaradchi and Uduppidi.

A number of Gootee layerings of mango, orange, mandarin, etc., from the Weragoda Garden were sent for planting in the Bandaragama Garden during the last season.

Seeds of the Burdwan and Kali varieties of brinjal received from the Government Botanic Gardens, Bangalore, were sent in October last to Ukuwela, Kegalla, Matara, Jaffna, Hettipola, Galle, Kalutara, Kandy and Peradeniya.

Chestnuts (*Castanopsis tribuloides*).—Through the courtesy of the Conservator of Forests, Southern Circle, Burma, a quantity of edible chestnut seeds collected in the Maymyo range of the Mandalay Forest Division, was received and is under trial at Peradeniya and Hakgala.

Soya Beans.—The following eighteen varieties of Soya Bean were received from the Economic Botanist of Bihar and Orissa :—

Black, late	Nepali, twining
Black, early	Yellow, erect
Yellow, hilum brown	Black, erect
Green yellow, large hilum dark brown	Barmeli, twining
Assam	Barchet
Chocolate	Riceland
Pale Chocolate	Black mottled, Java
Barmeli, erect	Dull Terra Cotta brown
Nepali, erect	Dull brownish black

These will be tried in localities likely to prove suitable.

Plectranthus tuberosus (Innala S.).—A quantity of this was supplied to the Deputy Director of Agriculture, Burma.

MISCELLANEOUS.

Thanks are due to MUDALIYAR A. E. RAJAPAKSE for the gift of a collection of Ceylon coconuts for the U. S. Department of Agriculture, consisting of 18 varieties.

MR. P. M. ELIAS, Tea Planter and Seed Merchant, has to be thanked for a gift of a quantity of tea seed for the Walapane Co-operative Credit Society.

C. DRIEBERG,
Secretary, C. A. S.

Peradeniya, 25th February, 1918.

PLANT SANITATION.

FUNGUS DISEASES OF FOOD CROPS IN CEYLON.

T. PETCH B.A., B.Sc.,

Botanist and Mycologist.

It is a common experience that plants which have grown vigorously and have given their owners every prospect of an abundant crop suddenly begin to die off. At first, one or two plants only may succumb, but the trouble generally spreads, gradually or rapidly, until all the plants are affected. To those who grow food crops for market, the losses occasioned in this way are often very serious, while those who grow vegetables merely for their own consumption suffer disappointment which frequently deters them from making further attempts.

At the present time, when food of all descriptions is urgently required, it is of the greatest importance that growers should recognise what these losses are due to, and take steps to minimise them.

If no insect can be found attacking the plants, it is a fair assumption that their death or injury is caused by a fungus. A fungus, it may be explained, is a plant which feeds on other plants. Some fungi attack only dead plants and therefore cause no damage, but others attack living plants and set up diseases which result in injury or death to the plant attacked. These latter, parasitic, fungi are responsible for enormous annual losses in our cultivated crops.

It is to be noted that, as a rule, the body of a parasitic fungus consists of fine threads which penetrate the tissues of the plant attacked and cannot be detected without a microscopic examination. To the cultivator, the disease has to to be recognised by its effect on the plant. When the fungus fruits, its fructification may be visible to the naked eye, often in the form of a fine powder. This powder consists of innumerable spores, which can infect other plants if they are conveyed to them by the wind or by other means.

Diseases of plants are caused by parasitic organisms, and are infectious.

The most serious diseases of vegetables, etc., are the root diseases. When attacked by a root disease, the whole plant generally turns brown and dries up. In some cases, the leaves of the plant first of all droop, as though it was suffering from a lack of water. This, indeed, is actually the case, as the fungus attacks and destroys the root, and often blocks the water channels of the plant, so that the supply of water to the leaves is cut off. From the sudden drooping of the leaves, such root diseases are often known under the general name of wilt.

A plant attacked by root disease cannot be cured. All that can be done is to prevent the spread of the disease to other plants. With that object in view, the dying or dead plants must be dug up and burnt. If the disease is caused by a fungus, lime should be scattered over the place where the affected plants grew, and lightly forked in. But unfortunately many of

our wilt diseases are caused by Bacteria, and in such cases liming is of little use.

The root disease of cabbages known as Club root may be minimised by liberal liming prior to planting. Lime should also be used in the root diseases caused by Sclerotium. But the common wilt disease of Tomatos is caused by bacteria.

When plants have been seriously attacked by root disease, the plot should not be used for the same kind of plant for a considerable period. In the case of the Tomato wilt, neither Tomatos, Brinjals, nor Chillies should be planted on the diseased area for several years.

Leaf diseases are indicated by the occurrence, on the leaves, of various-coloured irregular patches, or by a white powdery coating in the case of the Mildews, or by a scattered brown powder in the case of the rusts. As a rule, leaf diseases do not kill the plant, but they weaken it and reduce the crop, thereby making it less profitable. It is customary to treat leaf diseases by spraying, but if this is impracticable for the small grower, something may be done at the beginning of an attack by gathering and burning diseased leaves.

The Powdery Mildews (not the Downy Mildews) may be stopped by dusting the plants with Flowers of Sulphur. Many Mildews grow on common weeds, and hence the vegetable garden must be kept clean-weeded.

In Fruit Diseases, the fungus attacks the fruit and causes it to decay, usually in a soft rot over a limited patch at first. Here again, spraying is the recognised method of preventing fruit diseases. The only other remedy is to gather and burn the diseased fruits, and in doing this none but diseased fruits should be handled. If when gathering diseased fruits the sound fruits are handled to see whether they are attacked, the spores of the disease will inevitably be conveyed to them.

It will be noted that in all cases diseased plants or parts of plants must be burnt. This is an elementary precaution which is within the reach of all growers, but one which is only too often neglected. Diseased plants must not be thrown on the rubbish heap and left there to decay, or perhaps to be returned to the garden later in manure or mulch. Such methods merely propagate diseases.

Much can be done to minimise the risk of disease by a close attention to cleanliness in the garden. All weeds should be eradicated, nothing but the crops being allowed to occupy the ground. Rubbish should be periodically cleaned up and burnt, and the rubbish heap should not be situated in the garden itself. It is a good plan to burn the refuse of past crops, especially cabbage stalks, pea and bean vines, tomato plants.

The rotation of crops is another measure which tends to lessen the amount of disease, as it prevents the diseases of the preceding crop passing on to the next. But in this, care must be taken not to plant in succession closely-related species, such as Brinjals or Chillies after Tomatos, Ginger or Turmeric after Arrowroot, etc.

CEYLON DISEASES.—AMU.

Smut. (*Sorosporium Paspali*). Converts the grain, or the whole head within its sheath, into a black powder.

Rust (*Uredo Paspali-scrobiculati*). Forms narrow red-brown powdery streaks along the leaves.

ANISEED.

Wilt, caused by bacteria. Leaves collapse and hang down in dry brown tassels. Leaf stalks and stems turn yellow. Tap root blackens upwards from the tip, and its outer layers are soft and watery and separate easily from the central wood.

ARROWROOT.

Soft rot (*Sphærostilbe repens*). The underground stem becomes soft and rotten. On the outside are found broad red strands, which penetrate into the interior. Burn diseased stems, and fork in lime over the affected soil.

ARTICHOKE.

Root and tuber disease (*Sclerotium* sp.). White strands overrun the tubers and the base of the stem, and spread over the surface of the soil to neighbouring plants. Small hard brown grains, like mustard seed, are produced on these strands : these propagate the disease. Collect and burn diseased stems and tubers, and any white patches on the soil ; and fork in lime.

BANDAKKA.

Mosaic disease. Cause unknown. Leaves become mottled, green and yellow, and frequently misshapen. Burn affected plants.

BEANS.

Broad Bean. Rust (*Uromyces Fabæ*). Leaves covered with a brown powder. Diseased plants should be burnt after the crop has been gathered.

French Bean. Rust (*Uromyces appendiculatus*). Small brown spots on the leaves, on which minute brown powdery masses are produced. This disease occurs on many kinds of bean in Ceylon, *e.g.* Lima bean, Cowpea, Daradambala, Kollu, etc., but does not appear to cause serious damage. It might be reduced by always burning bean stems, etc., after the crop has been gathered.

Lima Bean.—Downy Mildew (*Phytophthora Phaseoli*). Attacks the pods, which become covered with a white fluffy mass.

BEETROOT.

Leaf spot (*Cercospora beticola*). Red brown spots which turn black and crack, forming irregular holes in the leaf.

BRINJAL.

Dieback (? *Fusarium* sp.). The side shoots die back to the main stem, which is then attacked by the disease at the joints. Fluffy white masses are produced at the joints. Prune off and burn the diseased shoots.

Little Leaf. Cause unknown. The plant produces large numbers of small leaves in clusters at the ends of the branches instead of the normal large leaves and flowers. Affected plants should be uprooted and burnt. Any wild chillies which show the same abnormality should also be burnt.

Mildew. (*Oidium* sp.). A white powdery coating on the leaves.

CABBAGE, CAULIFLOWER.

Club Root (*Plasmodiophora Brassicæ*). Forms nodules or swellings on the roots, which afterwards decay. A very infectious disease which is conveyed from place to place in soil adhering to tools, etc., Burn all diseased plants and apply lime at the rate of eighty bushels per acre.

CABBAGE, CHOU MŒLLIER, KNOL-KOHL.

Soft rot (Bacterial). Attacks the stem and converts the tissues into a soft decaying mass.

CASSAVA.

Leaf Spot (*Septoglœum Manihotis*). Brown spots on the leaves.

CELERY.

Leaf Disease (*Septoria Petroselini*). This disease is introduced with the seed. The seed should be steeped for three hours before sowing in a dilute solution of formalin (one part of commercial formalin to six hundred parts of water). See TROPICAL AGRICULTURIST, August 1917, pp. 102-104.

CHILLIES.

Fruit Disease (*Vermicularia Capsici*). Circular discoloured spots on the fruit, covered with minute black points. Gather and burn diseased fruits.

Mildew (*Oidium*). A white powdery coat on the leaves. Common on the wild Bird Chillies.

Root Disease (*Sclerotium* sp.). Same as on Artichoke.

Root Disease (*Rosellinia*). Black or grey strands on the root.

Little Leaf. Cause unknown. The plants produce large clusters of small leaves at the ends of the branches. Common on wild chillies. See Brinjal

CUCUMBER, PUMPKIN.

Mildew (*Oidium*). A white powdery coat on the leaves.

DHALL.

Rust (*Woroninella umbilicata*). Minute red swellings on the stems and leaves, which burst and produce an orange-red powder. Prune off and burn diseased branches.

GINGELLY.

Mildew (*Oidium*). A white powdery covering on the leaves.

Leaf spot (*Cercospora Sesami*). Small whitish spots with a purple margin; the affected leaves fall off.

GROUND-NUT.

Leaf Spot (*Septoglœum Arachidis*). Small black spots on the leaves. When Ground nuts are grown in new localities the seeds should be steeped, before sowing, in dilute formalin, one part commercial formalin in four hundred parts of water.

HORSERADISH.

Leaf Spot (*Macrosporium hurculeum*).

MUSTARD.

White Rust (*Cystopus candidus*). White swollen spots on the leaves, at first smooth, then powdery. The upper part of the plant is often distorted. Badly affected plants should be removed and burnt. This disease occurs on Shepherd's Purse, which is a frequent weed in upcountry gardens and should always be destroyed when found.

Downy Mildew (*Peronospora parasitica*). White downy patches on the underside of the leaves. Collect and burn.

PADDY.

Sclerotial disease. Plants stunted; head small and empty; stems weak and hollow at the base, usually with large numbers of roots at the joints. Diseased plants usually occur in patches, and should be uprooted and burnt.

PEA.

Leaf spot (*Ascochyta Pisi*). Leaves covered with yellowish-white spots.

Mildew (*Erysiphe Polygoni*). A white powdery covering on the leaves.

SORGHUM (DHURRA)

Smut (*Cintractia Sorghi-vulgaris*). The grains are converted into cylindrical columns filled with a black powder. The seed should be steeped for fifteen minutes before sowing in a solution of copper sulphate, half an ounce of copper sulphate to one bottle of water.

Wet Weather Mould (*Cladosporium* sp.). This occurs if the grain ripens in wet weather. The whole head turns black, owing to the growth of a dark coloured mould on the grain.

TOMATO.

Wilt (*Bacillus Solanacearum*). The leaves droop and the stem is usually discoloured internally at the base. Diseased plants must be uprooted and burnt. Tomatos, Brinjals, or Chillies should not be planted in the affected ground.

Leaf Disease (*Cladosporium fulvum*). Dark spots on the leaf, with a brown velvety covering on the under surface.

Leaf Curl. Leaves curl towards the under surface, and frequently bear small warts along the veins. Not caused by a fungus, but attributed to an excess of moisture.

Fruit Disease (*Glæosporium phomoides*). Spots circular, sunken, yellow-green, black in the centre with a continuous hard black crust underlying the skin; sometimes with black strands extending to the centre of the fruit.

Fruit Disease. Blossom End Rot (Cause uncertain). Spots circular round the style or blossom end of the fruit, at first watery green, becoming mottled light and dark brown, and dry.

Fruit Disease (*Vermicularia Capsici*). Spots circular, not sunken, greyish brown or pale, covered with minute, black pustules.

Fruit and Leaf Disease (*Phytophthora*). Leaves turn black, and black patches appear on the stem. On the fruit the diseased spots are brown, mottled with blackish brown, often in concentric rings.

Fruit cracking. Due to variation in the water supply, especially when rain falls after a period of drought. Thorough cultivation or mulching is the only remedy.

N. B.—To avoid fruit diseases of Tomatos, the planting should be timed so that the fruits will ripen in the drier seasons.

YAMS.

Gahala, etc.—Tuber and Leaf Rot (*Sclerotium* sp.) See Artichoke.

Leaf Spot (*Phytophthora Colocasiæ*). Large brown spots on the leaves.

YAMS.

Kiri-kondol, etc.—Rust (*Uredo Dioscoreæ*). Orange powdery masses on leaves and stems.

IMPORTATION OF PLANTS &C. INTO INDIA.

The Department of Agriculture, Ceylon, has received the following notification on the subject of importation of plants etc. into India from the Agricultural Adviser to the Government of India:—

No. 13—C.

GOVERNMENT OF INDIA.

DEPARTMENT OF REVENUE AND AGRICULTURE.

AGRICULTURE.

Delhi, the 7th November, 1917.

In exercise of the powers conferred by section 3, sub-section (1) of the Destructive Insects and Pests Act, 1914 (II of 1914), the Governor General in Council is pleased to issue the following order for the purpose of prohibiting, regulating and restricting the import into British India of the articles hereinafter specified.

1. In this order:—

(i) "Official certificate" means a certificate granted by the proper officer or authority in the country of origin; and the officers and authorities named in the third column of the Schedule are the proper officers and authorities to grant in the countries named in the second column the certificates required by the provisions referred to in the first column thereof;

"plant" means a living plant or part thereof but does not include seeds; and "prescribed port" means any of the following ports, namely, Bombay, Calcutta, Dhanushkodi, Karachi, Madras, Negapatam, Rangoon and Tuticorin;

(ii) All provisions referring to plants or seeds shall apply also to all packing material used in packing or wrapping such plants or seeds.

2. No plant shall be imported into British India by land or sea by means of the letter or sample post.

3. No plants other than fruits and vegetables intended for consumption, potatos and sugarcane shall be imported into British India by sea except after fumigation with Hydrocyanic Acid Gas and at a prescribed port:

Provided that plants which are infested with living parasitized insects and are intended for the introduction of such parasites may be imported without such fumigation if they are accompanied by a special certificate from the Imperial Entomologist to the Government of India that such plants are imported for the purpose of introducing such parasites.

4. Potatos shall not be imported into British India by sea, unless they are accompanied by—

(i) a certificate from the consignor stating fully in what country and in what district of such country the potatos were grown and guaranteeing that warty disease was not known to exist on the farms where the potatos were grown; and

(ii) an official certificate that no case of warty disease of potatos has been known during the twelve months preceding the date of the certificate within five miles of the place where the potatos were grown.

5. Rubber plants shall not be imported into British India by sea unless they are accompanied by an official certificate that the estate from which the plants have originated or the individual plants are free from *Fomes semitostus* and *Sphærostilbe repens*.

6. Sugarcane shall not be imported into British India by sea unless it is accompanied by an official certificate that it has been examined and found free from cane borers, scale insects, Aleurodes, root disease (any form),

apple disease (*Thiela viopsis ethaceticus*), "Sereh" and cane gummosis:

Provided that canes for planting intended to be grown under the personal supervision of the Government Sugarcane Expert may be imported direct by such Expert without such certificate.

7. Coffee plants shall not be imported into British India by sea from America (including the West Indies) except by the Madras Department of Agriculture.

8. Seeds of coffee, flax, *bersim* and cotton shall not be imported by land or by sea by letter or sample post.

9. Coffee seeds shall not be imported into British India by sea from America (including the West Indies) except by the Madras Department of Agriculture.

10. Flax seeds and *bersim* (Egyptian clover) seeds shall not be imported into British India by sea, unless the consignee produces before the Collector of Customs a license from a Department of Agriculture in India in that behalf.

11. Cotton seeds shall not be imported by sea except after fumigation with carbon bisulphide and at a prescribed port.

R. A. MANT,
Secretary to the Government of India.

SCHEDULE.

[Paragraph 1 (i)]

1	2	3
Paragraph	Country of Origin	Authority.
4 (ii)	Great Britain and Ireland	The Board of Agriculture and Fisheries, England. The Board of Agriculture for Scotland. The Dept. of Agriculture & Technical Instruction for Ireland.
	Sweden	The Ministry of Agriculture.
	Norway	The Norwegian Board of Agriculture.
	Denmark	The Ministry of Agriculture.
	France	The Ministry of Agriculture.
	Japan (including Formosa)	The Department of Agriculture and Commerce.
	Italy	The Ministry of Agriculture.
	British East Africa ...	The Department of Agriculture.
	Australia	The Departments of Agriculture, Victoria, South Australia, New South Wales, Queensland, Tasmania and Western Australia.
5	Ceylon	The Department of Agriculture.
	Malay Peninsula ...	The Dept. of Agriculture, Federated Malay States.
	Dutch Indies	The Dept. of Agriculture, Industry and Commerce.
	Belgian Congo ...	The Department of Agriculture.
	British East Africa ..	The Department of Agriculture.
	Uganda Protectorate ...	The Department of Agriculture.
	Nyassaland ...	The Department of Agriculture.
	South Africa	The Union of South Africa Dept. of Agriculture.
6	Dutch Indies	The Dept. of Agriculture, Industry and Commerce.
	Mauritius	The Department of Agriculture.
	Philippine Islands ..	The Bureau of Agriculture.
	Japan (including Formosa)	The Department of Agriculture and Commerce.
	South Africa	The Union of South Africa Dept. of Agriculture.
	Egypt	The Ministry of Agriculture.
	West Indies	The Imperial Department of Agriculture, Barbados.
	British Guiana ..	The Department of Science and Agriculture.
	Trinidad	The Department of Agriculture.
	Jamaica	The Department of Agriculture.
	United States	The Department of Agriculture.
	Ceylon	The Department of Agriculture.
	Malay Peninsula ...	The Dept. of Agriculture, Federated Malay States.
	British East Africa ...	The Department of Agriculture.
	Queensland	The Department of Agriculture and Stock.

RICE.

SOWING SPROUTED SEED IN WET PADDY SEED BEDS.

It is the common, almost the universal. practice to sow seed in wet paddy seed beds which has been allowed to germinate slightly. The exact method of doing this varies in different places,—the practice is common all over India—but generally the seed is moistened either in a vessel or in a bundle of twisted paddy straw and kept for a period of 24 to 36 hours by which time the small rootlet has definitely emerged. The exact reason for this practice is not quite clear and in order to elucidate the matter, the opinions of the Deputy and the Assistant Directors were recently asked. The replies received do not show perfect unanimity; one officer considers that the question is largely one of temperature; more than one think that elimination of light seed is thereby obtained, while all agree that more even germination is thus obtained. This is conceded on all hands, but just how or why needs a little working out. Let us consider just what the conditions are in a wet i.e. puddled seed bed, for it is only in these conditions that sprouted seed is used. There is a layer of about a couple of inches of water over the surface, a very soft well puddled layer of soil, on to which the seed is to fall. After sowing the water is drained off, and the land subsequently only lightly watered till the seedlings are well established.

What now will be the effect of germinating the seed? Firstly it will probably be of higher specific gravity, as though its bulk has slightly increased, it has absorbed a considerable quantity of water. This will make it more inclined to remain where it is on reaching the soil and this is at once an advantage since if the seed moved about with the movement of the water admitted into and drained from the plot, it would stand little chance of success. The question of quick establishment is probably of the greatest importance in the whole business. The young rootlet can penetrate at once into the soft mud, so that any slight drying of the surface will not harm it. It is of course impossible to cover seed sown on puddled land; it must lie on the surface, and ungerminated seed would run the risk of finding the surfaces too dry and hard to penetrate with its tiny rootlets. It is suggested also that the sprouting, by producing a seed with a small projecting radicle, is thus instrumental in preventing this seed from sinking too far into the soil, and this is certainly a consideration. The question of the elimination of "deaf" or "shavi" grain is probably of less importance. There should not be much of this, and in any case it would be easily seen if the dry seed was sown in the nursery, while the process of soaking, often adopted in a bag or in a straw twist would not differentiate between good and bad seed.

Finally the germination of the seeds all together in the best conditions of temperature and moisture undoubtedly accelerates and facilitates germination. We know little about the actual germination reached by the seed sown under field conditions, but the percentage of failures must be in certain circumstances very high. Pre-germination, by giving every seed a good chance undoubtedly aid in getting a quick even plant. It seems a pity that the care used in producing the seedlings is so often neutralised by the carelessness in planting them.—R. C. Wood in the Journal of the Madras Agricultural Students' Union, January 1918.

EXPERIMENTS ON THE ARTIFICIAL HYBRIDISATION OF RICE IN JAVA.

L. KOCK.

The advantages of selection by hybridisation are first summarised in an introduction, then the results obtained by applying this method to rice, at Buitenzorg (Java), are described.

Among the varieties of rice cultivated in this district are :—"Karang Serang," a native of Carolina, characterised by its earliness and the good quality of its grain (heavy and bulky), and "Skrivimankotti," a native of Surinam, well-known for its high yields. In 1907, VAN DER STOK undertook hybridisation experiments with these two varieties in order to unite in one and the same type the productivity of "Skrivimankotti" and the high quality grain characteristic of "Karang Serang." Selection from the hybrids of the 2nd generation (F_2) was begun by isolating those plants which best correspond to the type aimed at in order to derive new lines from them. At the beginning the results of these experiments were not very satisfactory owing to the heterogenity and lack of stability among the progeny. This may, perhaps, be explained by the co-existence of *many* determinants for *one* character, which tend to diminish the number of and the opportunities for combinations showing the value. A further proof of this is the appearance in the hybrids of new characters found in neither of the parents, as, for example, black or pink awns, whereas "Karang Serang" has white awns and "Skrivimankotti" none at all.

It was only from 1913 onwards that some of the hybrids of the "Skrivimankotti" type began to show a certain uniformity and stability, an obvious sign that hymozygosis had been reached, at least for certain characters.

Below are given, for some of the hybrids obtained : (1) the weight per grain ; (2) the yield of paddy per acre. The corresponding figures for the stock-plant "Skrivimankotti" are also given.

	Weight per grain.	Yield of paddy per acre.
	mgr.	tons.
Stock plant "Skrivimankotti" ...	31·05	1·80
Hybrid No. 1	30·01	2·09
Hybrid No. 2	34·74	1·94
Hybrid No. 3	34·46	1·89
Hybrid No. 4	33·01	1·97

These hybrids, which surpass "Skrivimankotti" both in the quality of their grain and in yield, correspond fairly well to the desired end. The "Karang Serang" variety is still superior with regard to the weight per grain (37·23 mgr.), but it is quite possible that by selection and hybridisation still better gametic combinations may be obtained.

The most efficacious method of hybridisation is as follows :—Cut the top of the glumes with scissors a few hours before flowering, then remove the anthers with a fine needle, pollinate a few hours after with the pollen of another plant. It is not necessary to reclose the hybridised flowers, but the panicles are enclosed in a gauze envelope, which is protected at night and during rain by a little cover of dry leaves.

By this method the author, in one case, obtained 43·3% of successes. On tho other hand, the results were sometimes less good, or even negative, given the difficulties inherent to this method of hybridisation, and were largely dependent on the condition of the pollen at the time of pollination.—

BULL. INTERNAT. INST. OF AGRIC., September 1917.

TOBACCO.

TOBACCO SEED-BEDS.

H. W. TAYLOR, B. Agr.

Assistant Chief, Tobacco and Cotton Division, and Officer in charge, Tobacco and Cotton Experiment Station, Rustenburg.

The growing of seedlings for transplanting is the first step in tobacco production. Unfortunately many tobacco growers do not realize the importance of properly preparing and caring for their seed-beds and are often disappointed by not having sufficient plants for their requirements.

Tobacco seed are very small and therefore require a well prepared seed-bed in order that proper germination may be secured. On account of the smallness of the seed, their store of plant food is quickly utilized by the young plants which are then forced, very early in life, to draw on the soil for their food supply. For this reason, tobacco seed-beds should be in a high state of fertility and the soil should have an abundance of available plant food at the time germination takes place and a sufficient store to maintain a steady growth of the seedlings until they are ready for transplanting in the field.

TYPES OF TOBACCO SEED-BEDS.

In the colder tobacco producing countries where the growing season is short, tobacco seedlings are reared in either hot-house beds or in cold frames covered with glass. On account of our mild spring weather and long growing season it is not necessary for growers in South Africa to use either type of these expensive seed-beds as the open-frame type of seed-bed gives satisfactory results. The following remarks refer to the open-frame type of tobacco seed-bed and the steps which lead to successful results are outlined in more or less detail.

SELECTION OF SITE.

At the first tobacco seed-beds are sown in the late winter or early spring they should be placed where they will be sheltered as much as possible from the cold winds and at the same time be so situated that they will receive the maximum amount of sunlight, especially the sunlight of early morning. That the early morning sunlight is essential for the proper growth of certain plants was well established by RAWSON,* and the writer has noticed in many instances that this is true of the tobacco plant. The seed-beds should be located conveniently to water and should be near the homestead so that they will be constantly under the owner's supervision.

An eastern or north-eastern exposure is best while southern and south-western exposures should be avoided. If no natural shelter exists it will fully repay tobacco growers to provide artificial shelter, in certain districts, where heavy, cold winds prevail. These may be made with maize stalks, brush wood, or long grass. At the Piet Retief Tobacco and Cotton Experiment Station an excellent shelter was made with maize stalks, held in position

* TRANSVAAL AGRICULTURAL JOURNAL, Vol. IV., No. 15.

by double strands of wire. Seed-beds should not be placed too near large trees as the roots of the latter may rob the young plants of food and moisture and may also shade the beds too much. The site should be as level as possible to provide drainage as it is easier to prepare beds with an even surface on level land than on land with a slope. If the surface of the beds is not level there is danger of the seed being washed from the higher to the lower parts of the beds which results in an uneven stand.

SOIL.

The best soil for tobacco seed-beds is a deep, friable, light sandy loam of good fertility. This type of soil is usually well drained, retentive of moisture, and easily brought into good tilth. Very often this type of soil is not to be found on farms where tobacco is grown; then the grower must resort to the best type to be found on his place. Light sandy soils are preferable to heavy stiff clays. Where the proper soil for seed-beds cannot be found much can be done to change the texture of the soil and thus render it more suitable. The area required for seed-beds is not large, and if the soil is a stiff clay a few wagon loads of sand spread on the surface and thoroughly mixed with the soil, by several times ploughing or forking the land, will render it more suitable for the purpose. Black turf soil is rather too heavy for seed-beds and the plants are very slow in the early stages of growth. By applying sand to turf soil and thoroughly mixing the two, the writer has had excellent results; the plants being ready for transplanting sixty days from date of sowing. If the soil is too light and porous the texture can be considerably improved by an application of clay and *vlei* soil which should be thoroughly incorporated with the soil of the site.

PREPARATION.

The preparation of the soil for tobacco seed-beds should be commenced during the summer, previous to the spring, in which the beds are to be sown. About December or January the soil should be deeply ploughed and smoothed with the harrow. After about fourteen days the soil should be given a liberal application of old well pulverized kraal manure which should be turned under and the surface soil again finely pulverized. By applying the manure several months before the final preparation of the beds the farmer is certain that the manure will be entirely decayed before sowing time and will have changed into humus which is a most desirable form for manure to assume in tobacco seed-beds. Thereafter the soil should be ploughed at intervals until time for the final preparation of the beds. The frequent stirrings destroy weed and grass seeds and will thoroughly mix the manure with the soil which is highly important.

In the final preparation the site should be lined off into beds with pathways between. The size of the beds can be made to suit the site and the inclination of the grower. Beds in South Africa are usually made 3 feet wide when grass is used as a covering, but when cheese cloth is used for protection 5 feet is a more suitable width. After the beds have been aligned they should be sterilized.

There are various methods of sterilizing tobacco seed-beds and several methods are set forth in Bulletin No. 13 of the Union Department of Agriculture. The several methods of sterilizing enumerated therein, viz., open fire method, boiling water treatment, steaming, roasting the soil, and the

formalin treatment were tried at the several Experiment Stations of the Tobacco and Cotton Division, and the results uniformly proved that burning the soil with an open fire was the most effective means of sterilizing the soil as well as being the simplest in operation.

There are numerous reasons why tobacco seed-beds should be sterilized by the open fire method. RUSSELL and HUTCHINSON have clearly shown that when soils are heated to 98° C. and then moistened with water, that after a few days there is an increase in the available nitrogen content of the soil. The burning of clay soils makes them more porous and also renders their plant food more soluble.

By this burning process weed and grass seeds are killed, nematode and insects are destroyed, and the ash which results is an excellent fertilizer, as it contains carbonate of potash which is the best form in which potash salts can be applied to tobacco.

In burning seed-beds by the open fire method sufficient brush wood, cotton stalks, or other material should be placed on the soil to thoroughly heat it to a depth of at least 3 inches. When the soil is well burned it will have a light, dull red colour and will be very friable and easily pulverized. A very good test is to bury a potato about 3 inches below the surface, and when the potato has been cooked until the skin slips off easily the soil has been sufficiently sterilized. Seed-beds should not be burned when the soil is saturated with water, and on the other hand the soil should not be entirely dry. Soil containing just sufficient moisture to make cultural operations easy is in the proper condition for sterilizing by this method.

After burning, the soil should be allowed to cool; the beds are then enclosed with boards, burned brick or sheets of iron. The beds are then ready for an application of fertilizer before digging them over. An excellent fertilizer can be made up of 1 lb. nitrate of soda, 1 lb. of sulphate of potash, and 2 lb. of superphosphates. The several ingredients should be thoroughly mixed together and immediately applied to a seed-bed 3 feet wide by 30 feet long. After the application of fertilizer the seed-bed should be dug over to a depth of 3 inches, care being taken to thoroughly mix the fertilizer and ash with the soil. The seed-bed should then be brought to a fine tilth with the hand rake, special care being taken to leave the surface of the bed level, both longitudinally and transversely. If the surface of the beds is not level there is danger of the seed being washed from the higher to the lower portions of the bed which causes an uneven stand of plants. In this case the plants will be too thin in some places and too thick in other parts. When the surface has been properly levelled and thoroughly pulverized the seed-bed is ready for sowing.

SOWING.

Generally speaking, tobacco beds are seeded too thickly in South Africa. On account of the small size of the seed, tobacco growers do not realize the large number in a single teaspoonful. If growers will bear in mind that in each ounce of tobacco seed there are approximately 300,000 seeds and in each teaspoonful about 25,000 seeds, they will be able to more intelligently regulate the rate of seeding.

Tobacco seed when shelled from the seed pods contains a large proportion of dust and chaff, besides a very high percentage of light inferior seeds.

Both impurities and light inferior seed should be removed before sowing. It is not expected that every farmer will provide himself with the necessary apparatus for this work and such is not necessary. Every tobacco grower can send his seed to the Tobacco and Cotton Division, Union Buildings, Pretoria, and the seed will be graded and returned to him free from any charges. The fact has been definitely established that tobacco produced from heavy well developed seed is more uniform, both in size and colour, and produces a larger yield per acre than tobacco grown from light inferior seed.

If the seed has been properly graded one ounce is sufficient for 120 square yards of seed-bed. As every farmer does not have a scale which will weigh fractions of an ounce, the seed can be measured with sufficient accuracy with an ordinary teaspoon. In one ounce there are sufficient tobacco seed to fill an ordinary teaspoon level full twelve times. A seed-bed 3 feet wide and 30 feet long has an area of 10 square yards. If one level teaspoonful of seed is sown on a bed this size the rate of seeding will be approximately one ounce of seed to 120 square yards. If the seed has not been properly graded the amount should be increased 50 to 100 per cent. according to the proportion of impurities and immature seed in the stock. Tobacco seed when properly cared for will retain its vitality for a number of years. This enables the farmer to retain seed from an unusually healthy, uniform, and vigorous crop for several years, or until his crop again nears perfection, rather than save seed for each year regardless of the condition of the growing crop.

When such a small quantity of seed as one teaspoonful is to be evenly distributed over an area of ten square yards some fine substance must be used as a distributing medium. It has been found by practical experience that the most satisfactory materials are wood ashes and mealie meal, and both of these are usually at hand. Both are white and indicate plainly where they have been sown. The proportion of seed to the distributing medium is one teaspoonful of seed to one quart of wood ashes or mealie meal. The seed should be thoroughly mixed with the ash or meal and the whole distributed evenly over a bed 3 feet by 30 feet. It is best to sow the mixture both lengthwise and crosswise so that an absolutely even distribution is secured. After sowing, the seed should be lightly covered with either clean white sand or leaf mold. Great care should be taken that the seed are not covered too deeply or the tiny young plants will not be able to push through to the surface of the soil. It is a good practice to gently firm the soil after lightly covering the seed, and for this operation a plastering trowel is a very handy implement. Immediately after sowing, the bed should be watered with a sprinkling can which has a finely perforated "rose." From this time on the beds should not be allowed to become dry.

TIME FOR SOWING.

In the Transvaal many farmers sow their seed-beds too early. Often seed-beds are prepared and sown in May or June for October transplanting. The writer has found from practical results that the 1st of August is the best time for seeding beds which are to supply plants for October transplanting, provided the beds are properly prepared and well cared for. Sixty days from the date of seeding is ample time for plants to reach the proper size for transplanting when the beds are properly handled. With this time in mind farmers in most parts of the Union can prepare and seed their beds so that the plants will be ready for transplanting at the proper date.

All of the seed-beds should not be sown at the same time, but should be sown in succession, with intervals of about fourteen days. When this practice is followed the plants can be transplanted in succession as they reach the proper stage, and the other operations of cultivation and harvesting will take place in the same order, which makes the work of handling a large crop less difficult.

COVERING.

Some form of covering is necessary to protect the tender young plants from the hot sun during the day and the cold at night. In most of the tobacco growing areas in South Africa grass is used for covering tobacco seed beds, but there are several objections to its use. Grass often harbours the moth of the tobacco split worm (*Phthorimaea operculella*) which causes severe damage to the young plants and in some cases completely destroys the seed beds.

In addition, grass covering does not properly protect the young plants from cold winds, and it also causes the beds to be littered with trash which attracts white ants. Cheese cloth is the most suitable covering for tobacco seed-beds. KEILLEBREW says: "Nothing that has ever been invented or devised has effected so much for the tobacco grower, at such a small cost, as canvas (cheese cloth) covering for the seed-bed. It is an absolute protection against the ravages of insects; it hastens the growth of the plants by keeping the bed moist and warm; and it prevents the accumulation, on the bed, of drifted leaves and trash. The heat absorbed by the soil from the sun's rays during the day is radiated and lost at night in the open air; but under this covering it is reflected by the cheese cloth to the soil again, and thus a warm temperature is preserved, highly promotive of the growth of plants. A given area, protected by cheese cloth covering, will furnish at least a third more plants." Cheese cloth, if properly cared for, will last for several years, so that the cost per season for this covering is very low. If proper tobacco cheese cloth cannot be obtained butter muslin or coarsely woven hessian can be substituted.

CARE.

Tobacco seed-beds require constant care to secure the best results. Lack of attention for a few days will often cause the entire loss of seedlings through insect attacks or lack of moisture. There is probably no stage in the production of tobacco during which the crop demands such careful supervision and which will so amply repay any expenditure of time and money. The first and constant care of the tobacco grower is to see that the seed-beds are properly watered, This should be done with the watering can and not by irrigation. When the seed are first sown, and while the plants are small, the perforations in the "rose" of the watering can should be small, so that the fine seed are not displaced nor the soil washed from the roots of the tiny plants. When the plants have leaves, the size of a shilling, a "rose" with large perforations can be used if the grower desires, and after the plants reach a height of about 3 inches or 4 inches the "rose" may be removed from the watering can so that the work may be carried out more rapidly. Seed-beds should never be allowed to become dry, and on the other hand they should not be flooded with water. Moist, but not wet, is the proper condition for the soil of tobacco seed-beds. Should weeds and grass appear in the seed-beds these should be removed as they shade the young plants and also deprive them of food and moisture.

During the early stages of growth the cheese cloth covering should remain on the seed-beds during the whole of the day, it being folded along

one side of the bed only while the plants are being watered. Later the plants must be given sunlight for a short time each morning to prevent them from producing thin weak stems. The sunning period is gradually increased as the plants grow. About ten days before transplanting the cheese cloth is entirely removed to allow the plants to harden so that they can better withstand the shock of transplanting. During the last few days of the hardening period the beds are only given sufficient water to keep the plants from wilting. The plants are ready for extracting and transplanting in the field when they are about 6 inches in height. Just before the plants are extracted the seed-beds should be thoroughly watered so that the plants can be easily drawn without injury, and after all suitable plants have been removed the beds should be again watered to settle the soil around the roots of the remaining seedlings in order that their growth may not be checked.

Under certain conditions the plants in seed-beds fail to grow properly. The farmer should then ascertain the cause, which can usually be traced to water-logged soil, lack of plant food, or insect attacks. In case the trouble is caused by water-logged soil the treatment is obvious. In addition to decreasing the water supply to a minimum the condition of the plants is often improved by slightly stirring the soil to promote aeration. Sometimes the young plants turn yellow and growth ceases. This trouble is usually due to one of three causes, viz., excess of moisture in the soil; plants standing too close together ; or lack of plant food. In cases of excessive moisture in the soil the seed-beds should be treated as explained in the preceding paragraphs. If the plants stand too thickly on the ground the remedy is of course to thin them out so that they receive sufficient air and sunlight. Thinning also loosens the soil which promotes aeration and accelerates growth. The beds should be watered immediately after the plants are thinned. When plants turn yellow through lack of food, nitrogen is usually the element required. This plant food can be supplied by using guano, nitrate of soda, or fowl manure. The latter is the cheapest and is always at hand. It is best used in the form of liquid manure, but can be pulverized and broadcasted over the beds. If used as a liquid manure the solution is prepared as follows :—Fill a four gallon paraffin tin about half full of fowl manure and then fill with water. Let the mixture stand for several days, stirring at intervals. After about six days the solution is ready for use and should be applied at the rate of one quart of liquid manure to two gallons of water. A few days later a second application may be given. Nitrate of soda is used at the rate of one pound to eight gallons of water, and the solution can be applied immediately. Guano is used at the rate of one pound to six gallons of water. After applying any of the above solutions the seed-beds should be watered lightly to wash the solution from the leaves of the plants.

The principal pests which attack tobacco plants in the seed-beds are nematode (*Heleroda radidicola*) and the tobacco split-worm (*Phthorimœa opercullela*).

Nematode.—This is not an insect but a worm. There are many families of this group of worms, but the one in particular which attacks tobacco is known as the gall-worm.

This is the most serious pest with which tobacco growers have to contend, in many localities, and as the area of land infested is gradually becoming larger every effort should be made to control its spread and to exterminate it in soils already infested.

FULLER* states that "the life cycle of this nematode, from egg to egg, may take place in four weeks, or longer, depending on the temperature of the soil. The larval stage is that in which entry into the host takes place. It then becomes motionless and soon enlarges and undergoes a sort of metamorphosis, the males eventually recovering the original worm shape, while the females become pear or flask shaped and very much enlarged in their transverse dimensions. Each female lays 500 or more eggs. The winter is passed probably most frequently in the larval stage in the soil, but in case of galls on perennial roots the nematode may overwinter in these in a more advanced stage, even as practically mature and perhaps already fertilized females." On account of their minute size nematodes may be easily distributed in several ways. They may be conveyed from field to field by irrigation and in the soil which is washed from one field to another during heavy rains. Soil containing nematode is often conveyed from one field to another on tillage implements, the hoofs of animals or the boots of workmen. They may also be introduced into fields through using tobacco seedlings, or other host plants, which are infected. Once a field is infected the pest spreads rapidly, more particularly in sandy and sandy loam soils.

For rapid propagation the nematode requires a certain amount of warmth in the soil: the soil must be of loose texture and friable; a rather moist soil: and a host plant for food supply. These conditions can be taken advantage of in combating the pest. For land infested with nematode and not bearing perennial crops, FULLER recommends the following methods: "(*a*) Keeping the land free from vegetation of all kinds for two years. This is the most effective method but it is not practical in many cases; (*b*) planting the land to non-susceptible crops for at least (perhaps better three) years, using in the winter small grains, such as wheat, rye, or oats, and in the summer the velvet bean, Florida beggarweed, the iron cow-pea, or even peanuts. Scrupulously destroying all weeds that might harbour nematode; (*c*) making heavy applications of fertilizers, especially those containing potash, except where soils already contain this in abundance—this treatment often reduces nematode injury greatly; (*d*) flooding the land for a period of some weeks: (*e*) where rain is not likely to interfere, ploughing and allowing the soil to dry out for several months; (*f*) prevent by the use of embankments, ditches, etc., the washing of soil from infected fields to the field which it is desired to free from the pest."

Besides tobacco this nematode attacks potatos, beet, soya bean, sweet potato, lucerne, vetches, tomato, celery, watermelon, muskmelon, cucumber, squash, pumpkin, carrot, lettuce, egg plant, beans, parsnip, peas, and spinach, as well as a large number of garden plants and fruit trees.

After nematodes attack plants there is no practical remedy, so that every measure possible should be taken to prevent infection. The nematode attacks the roots of the host plant causing a knotted warty condition and abnormal thickness of the roots. On examination the roots are found to be usually soft and pulpy and lack the growth of fine rootlets found on healthy plants.

On account of the large number of plants attacked by the nematode the greatest care should be exercised in selecting a site for tobacco seed-beds which is not infected with this pest. Even though the spot selected is thought to be free from nematode the soil should be thoroughly sterilized by

* AGRICULTURAL JOURNAL, UNION OF SOUTH AFRICA, Vol. VI., No. 5.

the open-fire method to be certain that the seed-beds will be entirely clean. If the seed-beds are thoroughly sterilized by the open-fire method, and are protected from flooding by storm or irrigation water by earth embankments or open furrows, and if only clean water is used for watering, the seedlings should be free from nematode.

Tobacco Split-worm.—This insect attacks potatos as well as tobacco. For this reason, tobacco seed-beds should not be placed in soil which has just previously produced potatos. The split-worm attacks tobacco plants, both in the seed-beds and in the field, but the damage is usually comparatively light after the plants have been removed from the beds.

The injury is done by the insect in the worm or larval stage. The small greyish moth deposits its eggs on the stem or leaf of the plant. When the worm emerges from the egg it penetrates either the stem or leaf of the tobacco plant. If it enters the stem it eats out the interior and causes a gall like swelling of the stem around the place of injury. In this case there is no remedy, and the plants should be pulled out and destroyed as they are useless for transplanting in the field. Plants so affected never make satisfactory growth in the field, and reduce the yield by occupying space which could be utilized by healthy plants. When the worm enters the leaf it burrows between the two surfaces forming irregular transparent areas. It seldom remains for the whole larval stage in one leaf, but may attack two or more leaves. This habit is taken advantage of to combat the pest. The most effective remedy is arsenate of lead, applied at the rate of one pound to sixteen gallons of water. The plants should be sprayed thoroughly with this solution once every fortnight from the time the leaves are the size of a shilling until the plants are transplanted in the field. Prevention, however, is better than a cure. If the seed-beds are properly enclosed with boards or burned brick and covered with cheese cloth, the moth cannot get at the plants to deposit its eggs until the cheese cloth is removed to harden the plants, and then one application of arsenate of lead will be sufficient to prevent injury as the cheese cloth is not removed more than a fortnight before the seedlings are transplanted into the field. Grass coverings apparently attract the split-worm moth to the seed-beds, and this can easily be understood as the grass provides an excellent hiding place for the moth during the day.

The failures of the past season in the production of tobacco seedlings should cause the farmers to realize fully the importance of careful preparation and proper handling of tobacco seed-beds. In the Rustenburg District the short crop this season is largely due to the lack of seedling for transplanting. This shows plainly that lack of care at this stage in production may, and often does, mean the loss of a large part of the tobacco crop. If every tobacco grower will properly prepare his seed-bed, sterilize the soil by burning to kill nematode and insects, enclose the beds with cheese cloth to prevent insect attacks from without, and keep the beds properly watered there should be no shortage of strong healthy plants for transplanting. It should be borne in mind that a smaller area will be required to produce sufficient plants, and that the saving in time and labour by reducing the seed-bed area will offset any extra expense and care required to properly prepare and care for a sufficient number of tobacco seed-beds. It is also well to remind farmers that strong, vigorous, well-grown plants are better able to withstand the shock of transplanting than are weak and sickly ones.

To secure the best crop of tobacco the seedlings should be kept growing steadily from the time of germination until ready for transplanting. This period should not exceed sixty days when the seed-beds are so prepared and cared for that the conditions for growth are favourable.—BULL. No. 7., 1917, DEPT. OF AGRIC., UNION OF SOUTH AFRICA.

STUDIES ON TOBACCO SEEDS, IN JAVA.

HJ. JENSEN.

The author summarises the results of his studies on tobacco seeds as follows :—

(1) The small quantity of reserve food contained in the tobacco seed makes it necessary for the young plant to provide early for itself ; for this reason, the first few days following germination are most critical for tobacco.

(2) From 15 to 20 grm. of seed may be collected from each plant.

(3) Seed-capsules smaller than 17·5 mm. are of no value.

(4) By removing some of the seed-vessels from a plant, the number of the seeds is greatly diminished without improving their quality.

(5) The leaves may be removed from a plant without danger as soon as the first seed-capsules begin to ripen.

(6) The germinating capacity of seeds collected when they begin to mature is greater than that of half-ripe seeds.

This fact may be explained thus : The reserves of completely ripe tobacco seeds are composed of oils rendered assimilable by the ferments of the germ (lipase and others). At the beginning of maturation the oils are not yet formed, the reserve material is still directly assimilable by the embryo, and germination may take place. When the seed is about half ripe the oils begin to form, but it is only when the seed is completely ripe that the ferments form in sufficient quantity. If follows that the germ of half-ripe seeds cannot assimilate nutriment and germination does not occur. On the other hand in certain cases, the germinating capacity has been proved by drying half-ripe seeds; in other cases, drying unripe seeds (i.e. seeds collected at the beginning of ripening) or half-ripe seeds, has been detrimental.

For this reason preference should be given to seeds which are as ripe as possible.

(7) The seeds may be sorted with a sieve or a blower : the second method gives the best results.

(8) The seeds may be kept in tin boxes with lime without there being any danger of their germinating.—BULL. INTERNAT. INST. OF AGRIC., Oct., 1917.

TOBACCO EXPERIMENTS AT JAFFNA.

The experiments with White Burley Tobacco are being continued at Jaffna. A total of 10 acres have been planted with this variety and about two-thirds of this area is growing satisfactorily. In the sandier portions of the Trial Ground the general growth is not coming up to expectations but where the soil is of a heavier nature growth is promising.

Irrigation is being regularly carried on and further experiments with manures are being conducted.

Of all the imported varieties of tobacco with which experiments have been made at Jaffna, the White Burley kind is the only one that gives any promise, and there has recently been a demand from Europe for tobacco of the White Burley type which was grown and harvested at Jaffna in 1917.

THE INFLUENCE OF LIGHT ON THE GERMINATION OF THE SEEDS OF DIFFERENT VARIETIES OF TOBACCO.

J. A. HONING.

According to RACIBORSKI tobacco seeds do not germinate in the dark, a fact that is confirmed by experiments at the Deli Station. Therefore the writer was much surprised at GASSNER's classification of seeds, wherein he placed the seeds of *Nicotiana tabacum* in the group of seeds insensible to light. As he found 80·5% germination both for seeds in diffuse daylight, as well as in darkness, probably there must exist large differences between the varieties of *Nicotiana tabacum* in the need of light for germination.

An experiment with many varieties proved this supposition to be true. Just as RACIBORSKI states, the Deli-tobacco cannot germinate without the presence of light, (or only a very small percentage germinates), and the differences between the seeds of different origin or plants are small. But there are some other varieties which germinate in darkness almost as well as in light, though somewhat more slowly.

Experiments were carried out with 51 samples of seeds, 8 of Deli tobacco, 6 of West or Central European types, received from Scafati, 14 samples of varieties from the Balkans and Asia Minor, also from Scafati, and 21 of American species received from Washington, 1 of *Nicotiana quadrivalvis* and 1 of *N. rustica*. As a rule types from the Balkans and Asia Minor are the quickest in germinating in darkness and give the highest percentages.

Of the American varieties, some do not germinate without irradiation, just as Deli tobacco, and others germinate for a small percentage, not a single one coming above 50%.

The types from West and Central Europe take, with one exception, an ntermediate position.

Only the seeds of *Nicotiana quadrivalvis* agreed in their behaviour in darkness with the sample of *N. tabacum* used by GASSNER.—BULL. INTERNAT. INST. OF AGRIC., September, 1917.

EXPERIMENTS ON THE MANURING OF TOBACCO PLANTATIONS IN JAVA.

A. N. J. BEETS.

The difficulty of obtaining sufficient quantities of potassium sulphate lead the author to undertake experiments with a view to replacing this fertiliser by potassium silicate and the double sulphate of potassium and magnesium. The first contained 10·9% of soluble potassium, and the other 22·6%. The chlorine content was 2·75%

The experiments were carried out on soil in which the advantage of potassic manures had been proved by previous tests. A fertiliser composed of sulphate of ammonia, double superphosphate and potassium phosphate gave satisfactory results. The substitution of potassium silicate for potassium sulphate was also satisfactory. Still better results were obtained by the substitution of double sulphate of potassium and magnesium for potassium sulphate. The author points out, however, that the actions of the chlorine in this fertiliser may affect the burning qualities of the tobacco.—BULL. INTERNAT. INST. OF AGRIC., November, 1917.

SOILS AND MANURES.

THE CHANGES TAKING PLACE DURING THE STORAGE OF FARMYARD MANURE.

E. J. RUSSELL AND E. H. RICHARDS.

Summary of Results, and Application to the Storage of Manure.

We can now bring together the various results obtained during the course of our investigations.

We find that the changes are at a minimum under *anærobic* conditions, and they are as follows :—

1. In the laboratory experiments as much as 17% of the dry matter may be converted into gas : in the heap the proportion is less.

2. The non-nitrogenous constituents are particularly affected, as much as one quarter of the pentosans may disappear during the process and other constituents break down in like proportion. The gas evolved contains carbon dioxide, marsh gas, and hydrogen.

3. In the laboratory experiments the nitrogenous compounds also break down, part of the complex compounds giving rise to ammonia. More ammonia is found at 26°C. than at 158°C.

4. No nitrates are formed.

5. In the only heap where we were satisfied that the conditions were anærobic there was no accumulation of ammonia.

6. There is no loss of nitrogen during the process : the whole of the initial nitrogen being recovered within the error of the experiment.

The *ærobic* changes are as follows :

1. The loss of dry matter is greater and the temperature rises higher than under anærobic conditions. The gases evolved contain no hydrogen or marsh gas.

2. The loss of dry matter shows some relationship to the aggregate rise of temperature.

3. There is almost always a larger decomposition of complex nitrogen compounds than under anærobic conditions. There is not usually an accumulation of ammonia in the laboratory, and in the heap there is invariably a loss.

4. Nitrate is found in the dry outer portions of the heap, but not in the moister interior, nor was it found in the laboratory experiments where the manure remained moist : the necessary conditions appear to be dryness and sufficient air.

5. Under ordinary conditions of incomplete æration there is an evolution of gaseous nitrogen, though this is not observed when the conditions are wholly ærobic without any local anærobic action.

6. The loss of ammonia shows some relationship to the maximum temperature attained.

7. The loss of dry matter is greater from exposed heaps than from sheltered heaps and so is the loss of ammonia, unless this is already at a minimum ; but the loss of total nitrogen is not always greater.

8. The loss of nitrogen is not wholly dependent on that of dry matter, since as already stated it does not occur under purely ærobic or purely anærobic conditions, although other constituents are lost. But the loss of nitrogen that occurs in the mixed ærobic and anærobic conditions occurring in practice varies under comparable conditions, with the loss of dry matter, all constituents of the heap apparently breaking down simultaneously. An exception occurs when the temperature has risen high, e.g., to 70°C. after which decomposition of nitrogen compounds and loss of nitrogen proceed more slowly than loss of dry matter: an actual concentration of nitrogen in the heap therefore occurs. A second exception is seen in exposed heaps, when the loss of dry matter is usually proportionally greater than that of nitrogen.

9. The loss of nitrogen might occur by

(a) washing away of soluble nitrogen compounds,
(b) volatilisation of ammonia,
(c) evolution of nitrogen,
(d) other ways.

From the sheltered heap (a) is excluded.

It is further shown that (b) can hardly account for the observed losses in the heap, and certainly not for those in the laboratory experiments, where the extent of volatilisation was measured, and found to be only small. In the laboratory experiment an evolution of nitrogen has been demonstrated and presumably a similar change goes on in the heap.

10. In the laboratory experiments decomposition never proceeded very far, the maximum losses being 17% of dry matter, 30% of complex nitrogen compounds, and 33% of total nitrogen.

11. In our heap experiments we find this last fraction of complex nitrogen compounds, representing 50 to 60% of the original total nitrogen, only decomposes very slowly indeed.

We can now come to the application of these results to the practical problem of storing farmyard manure. It is unnecessary for us to go into details as this has already been done elsewhere.* We may, however, indicate the general outlines. In the first instance we must be quite clear as to what is wanted. This can only be determined by field trials, and our experiments recorded on pp. 505-507 show that the main factors which determine the value of farmyard manure are the total nitrogen and the ammonia: indeed it is possible to evaluate the manures on this basis provided the ammonia figures are adequately "weighted." The total dry matter is of obvious importance in view of physical effects, but we have no information as to the value of any particular non-nitrogenous constituents SJOLLEMA and DE WILDT regarded the pentosans as undesirable on the theoretical ground that they favour denitrification, but there is no sufficient evidence that the loss of nitrogen would be less without them.

The objects to aim at in a manure heap must be to secure

(1) as much dry matter,
(2) as much ammonia, and
(3) as little loss of nitrogen as possible.

Now the laboratory experiments show that these objects can all be attained by storing the manure heaps under anærobic conditions at about 26°C. There is a considerable formation of ammonia and no loss of nitrogen, although some loss of dry matter occurs.

* JOUR ROY. AGRIC. SOC. 1917, 77, 1-35.

The heap experiments, on the other hand, show that these desirable results are not attained in manure heaps, however well put up. However compact the heap some nitrogen is always lost and there is never an accumulation, but commonly a loss of ammonia. This result is not peculiar to our heaps ; it has been obtained by all other investigators whose papers we have been able to find. We conclude then, that the heap is not the ideal method of storing manure.

The conditions to be aimed at are complete anærobic conditions and a temperature of 26°C. and it is obvious that these can best be attained in a watertight pit or tank that could be closed so as to keep out oxygen and to keep in the carbon dioxide produced by fermentation. This would be the ideal method for storing farmyard manure.

But as this ideal method presents certain practical difficulties we must see how far the best methods of practice approximate to it, and whether any further improvements can be suggested.

Two cases arise :

1. Manure that can be left undisturbed under the beasts, e.g., manure made in the covered yards or stalls by fatting beasts.

2. Manure that has to be thrown out daily, e.g., manure made from dairy stock or from the horse stables.

1. All experiments show that manure left under the beasts suffers a loss of about 15% of its nitrogen; there is no accumulation of ammonia, but, on the contrary, less ammonia than corresponds with the digestible nitrogen in the food.

This method, therefore, is far from being perfect ; but in comparative experiments it has always come out better than heaps, and if the buildings are good and the manure is well made there is probably little scope for further improvment.

Further losses set in as soon as the beasts are removed or the manure is hauled out into a clamp. We have been unable to reproduce the strict anærobic results in a heap, however well it was compacted, and in only one case —the compact cow manure heap—were we even partially successful. There we lost only 4% of the dry matter, and none of the nitrogen, but we had no accumulation of ammonia. The other compacted heaps showed all the ærobic actions in different degree, in particular there was always a loss of nitrogen.

The losses become more serious if the heap is not properly compacted or if it is left exposed to the weather.

By omitting to compact the heap we lost an additional 3% of dry matter, and 24% of ammonia ; but in two cases out of three there was no change in total nitrogen as compared with compacted heaps. In general the effect of compacting is to delay rather than prevent decomposition. By leaving it exposed to the weather we lost an additional 8% of dry matter, 33% of ammonia in two experiments, and 10 per cent. in another, and 21% of total nitrogen in two experiments and 2% in two others, as compared with sheltered heaps. Field experiments showed that the crop producing power of the manure was considerably lowered by exposure and that even a slight shelter was beneficial.*

*JOURN. ROYAL AGRIC. SOC., 1917-77, 1-35.

It appears then that the heap is at best an imperfect method of storage, but that its defects are lessened by keeping it compact and sheltered, where it will neither be washed by rain nor suffer too much loss on drying, and in particular by avoiding summer storage.

It is difficult to suggest any alteration in method of clamping that would be a further improvement; the best practical men have probably developed the method as far as its fundamental imperfections allow, and the only hope of further advancement seems to be in the wholly fresh direction we suggest, —to set up some pit or tank where absolute anærobic conditions can be attained, and where the temperature can be kept at 26°C, or thereabouts. This has been successfully done for silage, the old stack silo having given place to the air-light concrete structure, and it may yet be accomplished for manure.

2. *Manure thrown out daily.*—From the start the conditions here are ærobic, which, as we have seen, involve marked losses of dry matter, of ammonia, and to a less extent of total nitrogen as well, and these are aggravated when the heaps are thrown out in the open and exposed to the washing of the rain and the drying effects of the sun.

Much can be done to improve matters by carrying the manure into a shelter, such as the Cheshire dungstead, a structure like a small Dutch barn surrounded on three sides by a low wall, the fourth being open to allow the cart to back in, and connect the manure. The Oxford manure house does not allow the manure to be so readily compacted. It is probable that the dungstead could be improved in some details, but at the best it still retains some of the imperfections of the clamp.

We think the best prospect of dealing with manure from dairy cows, is to aim straight away at storage in a pit or tank; but as no practicable device has been worked out* for the whole of the manure we are making a commencement with the most valuable part, the liquid excretions. A modification of the Belgian liquid manure tank, which is built under the animal to receive the liquid, furnished a suitable starting point. These new experiments are being carried out by one of us on the farm of the Hon. RUPERT GUINNESS at Hoebridge.

The solid excretions and the litter would still require to be dealt with, but even if no advance on present methods were made with these the loss would be shorn of most of its seriousness once the liquid were better treated.

The practical conclusions that we draw are :—

(a) The method of leaving manure under the beast in boxes or covered yards until it is wanted, remains the best that we can suggest where it is practicable.

(b) If the manure has to be stored it should be under anærobic conditions, and if possible at a temperature of about 26°c.

(c) No heap, however well compacted or sheltered, fully satisfied these requirements. Probably the making of the heap has been developed to as perfect a pitch as possible, and we have no further improvement to suggest.

(d) The best hope for improvement lies in storing the manure in watertight tanks or pits so made that they can be completely closed, and thereby allow the attainment of perfect anærobic conditions. The proper temperature would have to be maintained.

We are hoping the experience gained in the new Woking experiments will indicate a method whereby this end can be achieved in practice.—JOURN. OF AGRIC. SCI., Vol. viii., Part 4, Dec. 1917.

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* It is difficult to suggest anything wholly new in agriculture. An illustration of a manure pit can be seen in HALE'S *Compleat body of Husbandry*, 1756, and another in an interesting pamphlet by BOUSSINGAULT, *La Fosse a Fumier*, Paris, Béchet Jeune, 1858.

DAIRYING.

THE GANESHKHIND DAIRY HERD.

H. E. LORD WILLINGDON, G. C. I. E.,

Governor of Bombay.

In venturing to write a short description of my home farm at Ganeshkhind, I do so in the hope that it may stimulate greater interest in a branch of our agricultural industry, which, if properly developed, may prove to be an important addition to the activities and profits of those who are engaged in the occupation of farming.

In comparing the agricultural conditions of England with those of India we necessarily observe many disparities, of which perhaps the chief is the prevalence in India of peasant holdings and in England of considerable or large estates. There are, however, many exceptions to the normal state of affairs in both countries, and there are many parts of India where large holdings predominate. In such cases the main point of difference between our two countries lies in this fact, that the landowner in England is in most cases a farmer himself who has his own home farm, breeds his own stock, and cultivates some of his own land, and thus acquires a practical knowledge of agricultural life and takes a keen and sympathetic interest in the welfare of his tenants and labourers. In this country, on the other hand, the great landowner, who is himself a practical agriculturist on a large scale, is unfortunately rare. But an important feature of similarity for our present purpose in both countries is the existence of various fine breeds of cattle from which the breeder can select that best suited for his locality and purposes.

It is, I am convinced, largely the fact that the landowner has in England been a keen breeder of stock himself, which has produced the fine herds of cattle in that country, and which has encouraged the numerous agricultural shows, where we often find our King-Emperor, great landowners, and tenant farmers all competing in friendly rivalry, and the tenant farmer not uncommonly proving successful over his sovereign and his other august rivals. Is it too much to hope that a similar development in cattle breeding may take place in this country? That in future years we may find fine stud herds of the various breeds in India? And that landowners and farmers may add interest to their own lives and profit in their occupation by producing good stock true to type throughout the country? I am glad to be able to state that already in this Presidency two ruling princes are establishing stud herds in their States, His Highness the RAJA of RAJPIPLA having started a herd of Kankreji cattle at Nandod, and His Highness the Nawab

of Junagadh a herd of Gir cattle at Junagadh, while the Chiefs of Sangli, Jamkhandi, and Aundh are directing attention to the Krishna Valley and Khillari breeds—examples which I trust may be followed by many more princes, chiefs and landowners.

I do not wish it to be thought that I am of opinion that there are no good cattle bred in this country. On the contrary, in this Presidency alone there are several fine breeds, notably the Kankreji in the north, the Krishna Valley and Khillari in the south, the Gir cattle from Kathiawar, and the Karachi cattle from Sind. It is the very fact that at various agricultural shows I have seen magnificent animals that makes me urge a further and more organized development of this industry. Let me state the objections which I often hear raised to the encouragement of dairy cattle. It is said that the farmer in India care little for milk production but breeds entirely to produce good draught stock. My answer to that is that a good milking cow will produce just as good a draught bullock as a bad milker, that milk is becoming more urgently necessary for the inhabitants of our big cities' that a good milker costs no more to keep than a bad milker and therefore it must be a more profitable animal for the farmer. Again, it is objected that the buffalo is *par excellence* the milking animal of India, as it is claimed that its milk contains more butter fat than that of the ordinary cow, which is essential for the production of *ghee*. That may be true at the moment, but I am inclined to think that, with careful selection and breeding from the best milking strains and good management, dairy cattle may be produced in this country economically as paying an animal as the buffalo. Of this I am certain that no lover of cattle would prefer to keep a herd of buffalos, if he can secure equally good results from the many beautiful animals I have seen since I have lived in India. It is further objected that it is very difficult in some localities to find the men to look after the cattle, and that the conditions of the climate render the dangers of starvation to valuable stock constantly a matter of extreme anxiety. To the first of these objections I would reply that everything must have a beginning, and I see no reason to suppose that it is impossible to raise up a class of men who could take a keen interest in the care of cattle and become as efficient in this country as is the case in other countries. To the second I would say that the fears of famine are so much lessened by the conservation of fodder, by the development of railways to carry it to any stricken area and by the constant extension of all forms of irrigation, that this peril is becoming less and less every year. That there are difficulties I freely admit, but difficulties are made to be overcome. The main essential to success lies in the interest and supervision of the owner himself, without which little will be achieved.

I approach this question with all diffidence, for I have only the experience of four years in India, though I can claim to have had cattle for many years in England; but I think it is true to say that it has been a practical experience which few individuals have attempted, and which

confirms me in my view that there should be a great future for cattle-breeding in this country. Let me, therefore, express the hope that the example of my humble effort in this direction may be followed by others, and that our best breeds of cattle will be bred and perpetuated on the most scientific lines in future years.

May I, in conclusion, venture to give a few hints and suggestions to those who may be encouraged after reading this paper to start a dairy farm themselves?

1. The owner should personally supervise and pay constant visits to the farm. He should not expect results for the first three years, until the young stock he breeds are coming into profit. He will then be able to add to his herd the young heifers which he thinks are likely to prove the best milkers, and sell off the surplus stock by auction or otherwise, which will go to improve the cattle in his neighbourhood. He should keep a register of each cow in his herd, showing the calves she produces year by year and the amount of milk she gives through the year. I would further suggest that in starting stud herds every owner should, as we often do in England, name each animal by the name of the State or locality where it is bred, e.g., "Marie of Junagadh," "Rose of Rajpipla;" by this means it is possible to trace the stock of any herd, and buyers will always know from what foundation stock they come.

2. Give the cattle lots of exercise, and let them lead as far as possible their natural lives. Never tie young stock up; let them run in a paddock as soon as they can, and when shut up, put them in a shed with an open yard to run into.

3. Give the cattle lots of food. No animal can prosper unless it is properly fed, but with food and careful tending the cows will become more regular in their breeding and produce more milk, and young stock will come to maturity earlier if they are well fed and cared for in their early years.

4. Keep the farm and stables absolutely clean, and give the cows ample bedding when they are in the byre.

These are among the chief essentials which are necessary to the successful management of a farm. I have endeavoured to carry them out on my own, and I think my facts and figures will prove with not unsatisfactory results.

GOVERNMENT HOUSE DAIRY AND FARM.

Ganeshkhind Dairy and Farm were started in October 1913. They are situated in the Park at Ganeshkhind about a quarter of mile from Government House.

Buildings. The farm buildings consist of a cow byre containing 16 stalls built on the latest American system, a small dairy, silo, Dutch barn, sheds for young stock, and a calving shed. The buildings are all made of stone, and the cow byre is stone-floored throughout, thus enabling the herdsmen to keep the byre clean, which is the first important step if cattle are to be kept healthy and well. Each stall has a separate feeding trough with cold water laid on, thus making it possible for each trough to be kept clean, after each meal. The dairy has a tiled floor and glazed

tile walls, and is about twenty feet by ten, and consists of two small rooms, one containing the churn and butter-maker and the other a milk separator.

Silo. This is a stone building in which green fodder is stored and made into ensilage, which gives an excellent food for the cattle when fodder is scarce and expensive.

Dutch Barn. This is a stone building, bricked up on three sides, with one side left open, and is used for stacking any crops that have been cut until they may be required, and also for housing farm implements.

Acreage. The arable land consists of about 26 acres in which the principal crop is lucerne which is cut green for the use of the stable horses. The surplus is sold and finds a ready market. Maize, *jowar* (*Andropogon sorghum*), and other fodder crops are also grown for the cattle.

Stock. The farm started with eight cows, eight heifers, and one bull, and the breed is pure Karachi, or as it is sometimes, though less accurately, called Sindhi. To-day the stock consists of 53 head including 16 cows, 1 stud bull, and the remainder young stock. At an auction sale in September 1916, the sum of Rs. 3,200 was obtained for 16 surplus young stock, or an average of Rs. 200 per head.

Fodder. The cattle have good grazing during some months of the year in the park of 400 acres. They are turned out morning and evening to graze, and during the day the cows are tied up in the cow byre. Besides what they can pick up in this way, every cow has a daily ration of *chooni*, bran, cotton-seed and salt.

Milk. The supply of milk has been yearly increasing, and the amount of milk received from April 1916 to March 1917 totals 37,309 lb., or an average of a little over 3,100 lb., per month.

Milk received monthly from April, 1916, to March, 1917.

Month		Quantity in lb.		Average number of cows in milk during the month
1916.				
April	...	2,868	...	10
May	...	3,902	...	11
June	...	2,771	...	9
July	...	2,985	...	10
August	...	2,641	...	9
September	...	3,702	...	10
October	...	3,781	...	11
November	...	3,337	...	11
December	...	3,231	...	11
1917				
January	...	2,815	...	9
February	...	2,377	...	8
March	...	2,899	...	8
		37,309		

Accounts as per statement below show for 1915-16 a profit of Rs. 376-1-4 and for 1916-17 Rs. 1,168-12-8 after allowing interest on capital outlay on buildings, Rs. 12,000, and purchase of stock Rs. 3,000, at 5 per cent.

GOVERNMENT HOUSE DAIRY AND FARM.

Statement of Accounts from 1st April, 1915, to 31st March, 1916.

Cr.

	Rs. A. P.	Rs. A. P.
By Income of milk, etc.	5,201 -2 -0	
,, ,, lucerne grass sold	279 -2-10	
,, ,, *kadbi* sold	66-11 -6	
,, value of live stock sold	350 -0 -0	
,, ,, firewood sold	48 -0 -0	5,945 -0 -4
,, Stock of lucerne grass, *kadbi*, and hay in hand on 31st March, 1916, debited to next account		1,620 -0 -0
Total		7,565 0- -4

Dr.

	Rs. A. P.	Rs. A. P.
To stock of lucerne, *kadbi*, and hay, etc., brought over from last account	nil	nil
,, Establishment and labour	1,669-15 -0	
,, Ploughing expenses	203 -0 -0	
,, Hay making do	29 -0 -0	
,, Value of seeds purchased	259 -8 -0	
,, ,, fodder do	3,628 -6 -3	
,, Railway freight, and allowances	320-15 -6	
,, Value of new dairy appliances purchased, and repairs, etc.	314-15 -0	
,, Drugs and Veterinary Dispensary bills	100-14 -0	
,, Stationery, etc.	26 -3 -0	
,, Manure purchased	50 -0 -0	
,, Contingencies	285 -6 -3	
,, Cost of ensilage	70-15 -0	
,, Value of live stock purchased	229-13 -0	7,188-15 -0
		7,188-15 -0
Credit		376 -1 -4
Total		7,565 -0 -4

GOVERNMENT HOUSE DAIRY FARM.

Statement of Accounts from 1st April, 1916, to 31st March, 1917.

Cr.

	Rs. A. P.	Rs. A. P.
By Income of milk, etc.	4,663-10 -0	
,, ,, lucerne grass sold	1,471-13 -3	
,, ,, *kadbi* sold	265 -0 -0	
,, Value of live stock sold	3,474 -0 -0	9,874 -7 -3
,, Stock of lucerne grass *kadbi*, and hay in hand on 31st March, 1917, to be debited to next account		2,296 -0 -0
Total		12,170 -7 -3

Dr.

	Rs. A. P.	Rs. A. P.
To Stock of lucerne grass, *kadbi* and hay, etc., brought over from last account		1,620 -0 -0
,, Establishment and labour	1,947 -2-11	
,, Ploughing expenses	205 -8 0	
,, Hay making do	65 -8 -6	
,, Value of seeds purchased	614-12 -3	
,, ,, fodder do	3,395 -0 -2	
,, Railway freight etc., and allowances	1,039 -5 -6	
,, Value of dairy appliances and repairs	42-12 -0	
,, Drugs & Veterinary Dispensary bills	164 -6 -0	
,, Stationery, etc.	110 -6 -0	
,, Manure purchased	69 -9 -0	
,, Contingencies	648-12 -0	
,, Cost of ensilage	67 -6 -3	
,, Value of live stock purchased	261 -2 -0	
,, Interest on capital (buildings Rs. 12,000, and purchase of stock Rs. 3,000 @ 5%)	750 -0 -0	9,381-10 -7
		11,001-10 -7
Credit		1,168-12 -8
Total		12,170 -7 -3

LIST OF COWS IN MILK.

THE PROPERTY OF H. E. LORD WILLINGDON, G. C. I. E.

No.	Name of Cow.	Date of Birth	Date when purchased	Purchased from.	Sire.	Dam.	Calf.	Amount of yield of milk for 12 months April, 1916 to March, 1917.	Date when calved.	Date when covered	Remarks.
								lb.			
1	Sunder	1907	1913	Govt. House	Battasha	Pilwari	5th	2,593¼	17-8-17	19-11-16	Sold 20th Sept. 1917.
2	Krishni	1909	do	do	do	Sawali	3rd	1,190¼	3-5-16	20-7-17	" " "
3	Rungi	do	do	do	do	Pilwari	4th	3,245½	6-6-16	29-6-17	
4	Radhi	not known	21-6-13	Milty. Dairy	not known	not known	8th	1,435½	31-3-17	1-2-17	" " "
5	Nandi	do	do	do	do	do	8th	2,635½	2-12-16	11-8-17	
6	Lali	1-1-07	do	do	do	do	5th	3,760	13-4-17	8-5-17	" " "
7	Mor	not known	5-8-13	Karachi	do	do	7th	14	22-2-17	15-8-17	
8	Mari	do	27-8-13	do	do	do	6th	4,100	13-4-17	18-1-17	
9	Luckdi	do	5-8-13	do	do	do	7th	4,387	1-9-16		
10	Luxumi	do	12-8-13	do	do	do	8th	2,384¾	13-8-17		
11	Shevanti	do	May 1914	do	do	do	4th	3,217¾	28-7-17	14-7-17	
12	Piri	do	do	do	do	do	4th	3,713¼	16-2-17		
13	Yeshi	do	do	do	do	do	5th	4,175¾	31-8-17	13-7-17	
14	Tulsi	5-2-14			do	Tapti	1st		21-2-17	do	
15	Mahaluxumi	11-11-14			Sarja	Mari	1st		24-4-17		
16	Tansa	3-1-15			do	Tapti	1st		4-8-17		

—Agricultural Journal of India, Vol. XIII. Part I, January, 1918.

CO-OPERATION.

A MODEL VILLAGE CO-OPERATIVE SOCIETY.

In the beginning of 1910, one or two members of the Servants of India Society selected Hadapsar village, some eight or nine miles outside Poona, to start a co-operative credit society for the benefit of the poor Agriculturists. The original number of villagers at the time of registration of the society slowly grew to 30; and to-day it stands at 161. The members come from all the sections of the village community, and the society is thus truely representative of the various interests residing in the village. The society commenced its operations in April 1910, with the members' capital of roughly Rs. 2,500, supplemented by a Government loan of Rs. 2,000. The by-laws allowed, during the first year, borrowing by the society to the extent of Rs. 8,000, and an individual member could be given a loan up to Rs. 300 only on personal security. To-day the society is authorised to borrow up to Rs. 125,000 and can give to an individual member a loan of Rs. 2,000 purely on personal security. The society paid interest at the rate of 6 per cent. during the first year on deposits fixed for one year. Now it has been able to bring it down to 5½ per cent, on fixed deposits for one year, 6 per cent. is allowed on those fixed for two years, and 6¼ per cent, on sums that are fixed for three years and upwards. Loans are given to members at 9⅜ per cent. or half a pice per rupee per month, while some of the poorer members were paying interest to their money-lenders at 18 per cent. on the security of land and the crop. During the first year the amount collected by way of deposits from members, and outsiders amounted to Rs. 7,449. How far the society has been able to win the confidence of its members and the general public can be well gauged from the fact that the deposits received by the society last year amounted to Rs. 47,393, which sum is distributed as follows: Rs. 13,203 from members; Rs. 3,410 from women-members; Rs. 8,177 from male non-members in the village; Rs. 5,487 women non-members in the same village; and Rs. 17,116 from outsiders.

Women's contribution. The reserve fund during the seven years of transactions amounts to Rs. 11,520, and including this and other items such as deposits, entrance fees, gifts, etc., etc., the society has at its disposal to-day a capital of over Rs. 100,000. An interesting feature of these deposits is to be noted in the fact that about one-fourth of these comes from women including outsiders. An educational fund collected mostly by members for the purpose of affording greater educational facilities to the children of the villagers has been deposited and it now amounts to over Rs. 2,000. Even buried money amounting to nearly Rs. 4,000 has been unearthed by the society. Nearly as much interest as was earned by the society, during the first four years of its existence, was earned by it during the last year only. A sum of Rs. 24,656 has been procured so far, as interest by the society; on this basis it can be roughly estimated that the net gain to the members effected in respect of payment of interest can be roughly put at Rs. 25,000, and including other charges which every borrower has to pay in various shapes, it may be even put at nearly Rs. 50,000.

In all these transactions there has been no loss of a single rupee, members being as a rule prompt in their payments. Most of the loans are short-term, i.e., for 12 months; in a few cases the term of loan is extended to 20 months when the crop of sugarcane of a particular kind is delayed. Thus the working of the society has been extremely satisfactory; and so far there have been no suits in court. Members generally borrow for productive purposes, money being applied to agricultural needs, such as manure, seed, bullocks, agricultural implements, land improvements, fodder, water-tax, land-tax, sinking of new wells and repairing old ones. The members of the society own nearly half the sugarcane area of the village. Improved methods of agriculture are being steadily introduced. Supply of capital at a low rate of interest has also given an impetus to the improvement of agriculture. The area under sugarcane has increased, and 40 acres of these are cultivated according to the methods adopted by Government at the Manjari Farm. Ammonium sulphate, which the people had never heard of before, is now used to the extent of Rs. 2,000 nearly per year. Over 60 ploughs of the modern type have been bought by the villagers, and 10 new wells have been sunk. The work of the society has been done at a considerably low cost. the amount spent last year was less than Rs. 200. and this included the secretaries' pay. contingencies, etc., while the total turn over was Rs. 159,700.

Lord Willingdon's appreciation.—Speaking at the seventh annual meeting of so useful an institution, His Excellency LORD WILLINGDON said that co-operation was the corner-stone of agriculture and he wished to see as many agricultural co-operative credit societies established in India as possible. The Hadapsar Co-operative Credit Society was one of the model societies of this presidency. There was one point that had struck him rather forcibly, and that was the reference to the desire for litigation inherent in the people. As he saw it in the presidency, that desire had been followed by tragic and serious consequences, and he was delighted to find that through the work of their society they had reduced litigation. They had introduced a spirit of honest rivalry and, as it seemed to him, had fostered in their midst a spirit of co-operation and self-help. He congratulated them on what they had done. His Excellency wished at that stage to give expression to the obligation he felt himself under, to the selfless work and untiring energy displayed by the members of the Servants of India Society. To him it seemed as if the Servants of India Society, of which MR. DEVDHAR was a senior member, was never weary of well-doing for the benefit of the people of India. They must bear in mind the fact that if they wished to raise the people of India to a higher plane, they must do whatever lay in their power to better their condition. Unless they could infuse a brighter atmosphere into the homes of the people of India, unless they could help to render those homes more happy, and healthier than they were, they could not expect to uplift the people of the country. It was for this reason he was so pleased to be there that evening. They had started in a very small way as a co-operative credit society, but, as he understood, they had branched out. They now owned their own oil-engine and crusher, and he believed he had now to open the machine for crushing oilcake.

His Excellency hoped that responsible persons would come forward to take a real and particular interest in agricultural co-operation. If they could get up such a spirit throughout the length and breadth of India they would do an immense amount of good. Political reforms would come, personally he wanted them to come, but unless they raised up a class of citizens capable of giving sound advice to the people of this country, their work would not be well done. His Excellency was perfectly confident that as the society had done so well in the past it would be equally successful in the future. —REPRODUCED IN THE AGRIC. JOURN. OF INDIA, JANUARY 1918. FROM COMMERCE, dated 4th October, 1917.

GENERAL.

PHILIPPINE METHODS OF COCONUT OIL EXTRACTION.

In the Philippines, coconut oil is manufactured by modern methods with the use of hydraulic presses as well as by the natives who use ruder appliances. VILLYAR of the College of Agriculture presents as a thesis for graduation his investigations of native methods (*cf.* PHILIPPINE AGRIC. AND FORESTER VOL. VI. NOS. 2—3).

There are two methods adopted by the natives described as the "hand-press" and "machine-press" methods.

The "hand-press" method is very similar to the method adopted in Ceylon when oil is needed for domestic purposes. Such oil known as "home-made coconut oil" is considered to be of very superior quality.

The meat is scraped out and as much of the milk as possible is squeezed out by hand. This milk is boiled till all the water evaporates. As the milk contains about 50% to 60% of oil, the yield is very low.

In the "machine-press" method, the coconuts are described as first being husked. This is done in the same way as in Ceylon and is considered very efficient especially when done by expert workmen. The nuts are then broken into halves. The meat is grated out by means of a native machine called the "*kabyawan.*" It consists essentially of a convex iron burr mounted on the end of an axle and so arranged as to work by pedals. This apparatus was introduced sometime back into Ceylon by the Agricultural Society. It is considered very effective as in less than 30 seconds the meat can be removed from the half-nut. The meat, however, is very coarsely grated due to the large teeth of the burr. An improved American machine based on the principle of the *kabyawan* is used in some factories. Three men are used to run it instead of one as in the *kabyawan.* The meat is grated very fine and it is claimed for the improved machine that by its use 25 gallons of oil are produced from 1,000 nuts as against 20 gallons when the *kabyawan* is used.

Both machines are estimated to require three men to scrape in one day a thousand nuts.

The grated meal is next cooked with water in shallow iron pots. Of the types of furnaces used, the one recommended is a rectangular furnace built up with brick and mortar. Two openings are provided. One for putting fuel in and raking out the ashes. The other opening on the opposite end is fitted with a chimney. On the top of the furnace are two depressions into which the iron pans fit snugly. Iron pans with higher sides as used in soap factories are recommended instead of the shallow ones which need watching during the boiling process to prevent the milk boiling over.

The resulting white mash is put into rattan mat-bags and then pressed in a vertical press consisting of two large boards and a wooden screw. One end of the screw is fastened to the wall. The other end passes through the wooden boards into a threaded block. By turning this block great pressure can be applied to the front board.

A press with two wooden screws is recommended as this can press three bags at a time. No better substitute can be suggested for the mat-bags.

The juice squeezed out falls into a large wooden trough (galvanised troughs are to be preferred). The liquid is then boiled to obtain the oil by evaporating the water. This oil is of good quality and is used for culinary purposes.

After expression, the cake is allowed to ferment, it is then ground by means of wooden, stone or cement grinders. This is done six or more times till all the oil is squeezed out. This oil is of inferior quality and is used for illumination and soap manufacture. This method is a very slow one as the extraction of a charge of 1,000 to 12,000 nuts (depending on the size of the factory) requires from 5 to 8·5 days.

This delay is due to the fact that for thorough expression certain chemical actions (fermentation) must take place in the coconut meat.

The efficiency of the method ranges from 41·4% to 75·2% and averages 65·5% in the eleven native factories studied.

Of the 35% of oil lost, it has been calculated from actual analyses of samples that about 6% is lost in scraping operation, 2% in boiling, 10·7% grinding and that the "*latic*" or refuse contains about 6% oil. The rest must have been lost through leakage, handling, etc. This can be counteracted and may give a higher percentage of extraction than that calculated. Compared with modern methods the efficiency is low as it is stated that 93% is effected in the Philippines by modern methods.

The study of eleven factories show very well how the business qualities, management of labour, quality of nuts etc., affect the calculated efficiency. Under factory conditions the quantity of oil expressed from 1,000 nuts show considerable variation ranging from 16·25 to 27·5 gallons. The probable explanation of this variation is the difference in the size of the nuts and in the degree of ripeness when they are opened. This variation can be so considerable as to show in the working out of costs that many factories are run actually at a loss or with a most narrow margin of profit.

The best method of picking and aging the nuts is to allow them to fall by themselves and to store them for about three months before opening. It is advocated for this method that the copra and oil thus increases proportionately.

Labour management is another important item. The practice of paying separately for husking (e.g. $0·50 per 100), for scraping ($1·50 per 1,000) and for each can of oil extracted (e.g. $0·50), gives the fairest wages. By other practices the labourers are either underpaid or if they are well paid they bring up costs so high as to threaten the running of the factory with a loss or with a most narrow margin of profit.

H. L. VAN B.

"KAFIR" AND "MILO" SORGHUM AS GRAIN CROPS AND FODDER CROPS IN ARID SOILS.

EXPERIMENTS MADE IN THE ARGENTINE.

ABRAHAM VILLALBA.

With the exception of the most important varieties (*halepensis*, *saccharatum*, *scoparium*), the cultivation of sorghum as a fodder and grain crop is unknown in the Argentine. The author wished to test its suitability for the arid, dry-wind beaten districts of the southern part of the Republic. These districts are not suited to the cultivation of wheat or maize and are largely uncultivated. The experiments were carried out in various districts in collaboration with the farmers, and those made at Vilelas, in the centre of the Chaco of Santiago del Estero are specially described. Three varieties were used : (1) white kafir with black glumes ; (2) "colorado," or red, kafir ; (3) yellow milo. They were all sown on maize stubble, the soil being prepared by two consecutive harrowings ; a Planet cultivator was used. The yields per acre were :—white kafir with black glumes, 28½ cwt. ; red kafir, 29¾ cwt.; yellow milo, 39¾ cwt.

The milo ripened 8 to 10 days before the kafir and, in other districts as well, gave a higher yield than kafir.

The advantage of sorghum lies in its great vitality ; if it be destroyed by the teeth of animals, locusts, or other causes, it produces new shoots and still yields a harvest. Moreover, the grain ripens before the culm, and when it is harvested there remains an excellent and abundant yield of fodder. By sowing sorghum early, that is to say, in August or in September, one or two crops of green fodder and one or two crops of grain are obtained, according to whether, at the first harvest, the culms are cut low. Sorghum is very sensitive to frost. It does not encroach on the land and has very few enemies, the most harmful of which are birds.

The cultivation of non-sugar sorghum in the arid soils of the Argentine is strongly advised for the following reasons :—

(1) The above-mentioned varieties are more resistant to drought and hot winds than either maize or wheat ;

(2) Their cost price is less and their yield greater than those of maize or wheat. The following table is based on the average cost price and average unit yield for maize and wheat throughout the Republic, and for kafir in the Chaco Satiagneno :

Cost Prices and Unit Yields of Wheat, Maize and Kafir.

Expenses.	Wheat.			Maize.			Kafir.		
	£	s.	d.	£	s.	d.	£	s.	d.
Preparation of the soil, sowing, cultivation, etc.	2	4	0	1	15	2	1	15	2
Rent of Ground	0	17	7	1	6	4	0	8	9
Threshing, sacks, transport ...	1	4	7½	1	19	6½	2	12	9
Total Expenses ...	4	6	2½	5	1	0½	4	16	8
Yield per Acre ...	5½ cwt.			12 cwt.			24 cwt.		

(3) The food value of kafir flour is equal to that of wheat flour as the following table shows :—

Analyses of kafir and wheat flours.

	Kafir flour.	Flour of Santa-Fé Wheat.
Moisture	12·06 %	... 14·10 %
Nitrogen	9·52	... 12·60
Fat	1·55	... 1·60
Fibre	2·60	... 0·60
Starch	73·47	... 70·50
Ash	0·80	... 0·60

In starch value kafir is inferior to one cereal only—rice.

(4) Sorghum replaces maize very effectively as a food for human beings, domestic animals and poultry.

(5) In pig-breeding sorghum offers great possibilities on account of : (1) cheap land in the arid or semi-arid region of the Argentine ; (2) high yield in grain ; (3) low cost price.

(6) The culms form an important supplement to green fodder ; sometimes 2 crops of fodder and 2 crops of grain may be obtained per annum.—

BULL. INTERNAT. INST. OF AGRIC., September, 1917.

CULTIVATED AROIDS.

ABDILLA in the PHILIPPINE AGRICULTURIST AND FORESTER VOL. VI. Nos. 2-3 records some tests made with yautias and gabis. This is a continuation of the work begun by QUISUMBING and OCFEMIA, (*c.f.* T. A. May 1917 for a summary of their work).

These tests confirm the previous results that the yautias (*Xanthosome* sp. "Dèsé Ala" *Sinh.*) are the most profitable as field crops. In fact, the gabis and dasheens (*Colocasia* spp. "gahala" varieties) are shown to yield so poorly that they cannot be cultivated successfully under field conditions. To be a commercial success the yield should be at least 625 lb. of rootstock per acre. The *Colocasia* spp. at their very best do not give more than 450 lb. per acre.

The yautias show a wide range of variation in the yield of different varieties. It is recommended that they be planted 1 × 1 meter (or 3 × 3 feet) apart. On poor soils, closer spacing is advisable. The yield varies from about 1,200 lb. to over a ton of rootstocks per acre. The best soil for them is a rich, loose, sandy loam. It pays to cultivate them. This consisted of weekly intertillage and weeding during the first month of growth, fortnightly weeding and intertillage during the 2nd and 3rd months and after this till the time of harvest (seventh month), monthly weeding. With those planted in coconut and coffee plantations after the third month up to the time of harvest it was found that only one cleaning up was necessary.

The best yautias give about 4½ lb. of rootstock per plant. It is recommended that the upper parts of the rootstock be used for planting instead of tubers.

H. L. VAN B.

ANIMAL DISEASE RETURN FOR THE MONTH ENDED 28th FEBRUARY, 1918.

Province.	Disease	No. of cases to date since Jan. 1st. 1918.	Fresh cases	Recoveries.	Deaths.	Balance ill.	No. shot.
Western (Excluding Colombo Town)	Rinderpest	20	6	5	15	—	—
	Foot & mouth disease	3	—	3	—	—	—
	Anthrax	2	2	—	2	—	—
Colombo Municipality	Rinderpest	9	9	—	—	—	—
	Foot & mouth disease	22	20	—	—	—	—
	Anthrax	1	1	—	—	—	—
Quarantine Station	Rabies	1	1	—	—	—	—
	Anthrax	343	101	—	—	—	—
Central ...	Foot & mouth disease	62	48	22	1	39	—
Northern	Free	—	—	—	—	—	—
North-Western	Rinderpest	8	1	3	5	—	—
	Foot & mouth disease	7	—	7	—	—	—
Eastern	Foot & mouth disease	178	63	121	17	40	—
Sabaragamuwa	Free	—	—	—	—	—	—
Uva	Foot & mouth disease	8	—	8	—	—	—
North-Central	Foot & mouth disease	2145	1017	1965	37	143	—
Southern	Free	—	—	—	—	—	—

G. W. STURGESS, G.V.S.

METEOROLOGICAL.

FEBRUARY, 1918.

Station.	Temperature: Mean Daily Shade	Temperature: Difference from average	Mean Humidity	Mean amount of cloud 0=clear. 10=Overcast	Mean Wind direction during month	Daily mean Velocity	Rainfall: Amount	Rainfall: No. of Rainy days	Rainfall: Difference from average
	°	°	%			Miles	Inches		Inches
Colombo Observatory	77·3	-2·6	73	2·9	NNW	131	0·10	2	-2·05
Puttalam	75·6	-3·0	80	3·0	NNE	100	0·06	1	-1·27
Mannar	78·0	-2·1	70	3·8	NNE	160	1·07	4	-0·01
Jaffna	76·0	-3·0	75	2·6	NE	70	1·25	4	+0·04
Trinco'mee	77·8	-2·6	72	4·8	NE	145	1·57	5	-0·56
Batticaloa	76·0	-2·5	76	4·0	Variable	125	0·67	5	-2·83
Hambantota	75·7	-3·4	77	2·4	ENE	308	1·62	2	+0·08
Galle	77·2	-2·2	77	4·8	Variable	100	0·00	0	-2·79
Ratnapura	78·8	-2·2	68	4·4	—	—	4·26	5	-0·29
Anu'pura	76·1	-2·0	76	5·4	—	—	0·30	5	-1·21
Kurunegala	76·0	-4·2	65	3·8	—	—	0·06	2	-1·66
Kandy	73·3	-2·7	64	4·6	—	—	0·00	0	-2·41
Badulla	67·3	-3·6	74	5·6	—	—	0·57	3	-2·68
Diyatalawa	62·7	-3.1	66	4·7	—	—	0·25	2	-2·56
Hakgala	54·6	-3·4	76	5·0	—	—	0·44	7	-2·94
N'Eliya	54·2	-3·4	66	3·6	—	—	0·03	1	-2·17

February is usually a fine, dry month and was no exception this year.

The outstanding feature was its phenomenal coolness, being on the whole but one-tenth less than 3° F below normal. The range between the maximum and minimum readings was greater than usual as was the difference between the Wet and Dry bulb thermometers.

Air pressure was distinctly high.

Rainfall was below the average for the greater part of the Island. No rain being recorded in the extreme S.W., S.E. and the greater part of the N.W. Of the rainfall returns so far received St. Martin's Estate is the only station to have registered more than 5 inches

The wind direction was normal and the force normal to the North but greater than usual to the South.

The cloud amount did not deviate much from normal.

From records, a February under conditions somewhat similar to that just experienced is found to be usually followed by a period rather deficient in rainfall, especially in the first half of the year.

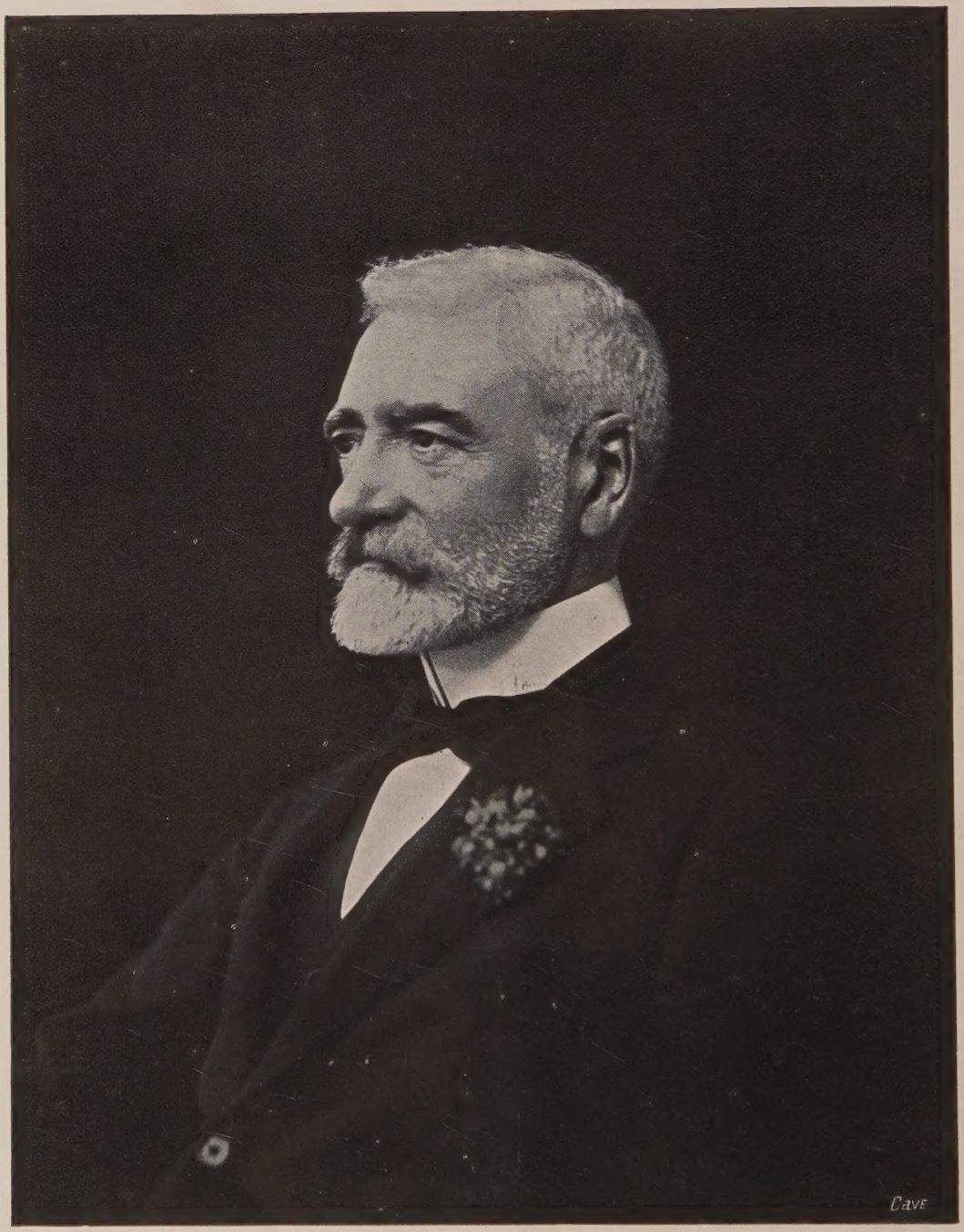
J. E. EVANS, Acting Supdt., Observatory.

MARKET RATES FOR TROPICAL PRODUCTS.

(From Lewis & Peat's Latest Monthly Prices Current.)

	QUALITY.	Quotations.
ALOES, Soccotrine cwt.	Fair to fine	95/ a 100/
Zanzibar & Hepatic ,,	Common to good	40/ a 105/
ARROWROOT (Natal) lb.	Fair to fine	7d a 8d
BEES' WAX cwt.		
Zanzibar Yellow ,,	Slightly drossy to good	£9 10/ a £9 15/
East Indian bleached ,,	Fair to good	£11 12/6 a £12
,, unbleached ,,	Dark to good genuine	£9 a £9 10/
,, Madagascar ,,	Dark to good palish	£9 5/ a £9 15/
CAMPHOR, Japan lb.	Refined	3/6 a 4/3
China cwt.	Fair average quality	Nominal
CARDAMOMS, Tuticorin	Good to fine bold	3/6 a 4/6 nom.
per lb.	Middling lean	2/ a 2/9 ,,
Malabar, Tellicherry ,,	Good to fine bold	3/ a 4/ ,,
Calicut ,,	Brownish	1/9 a 2/6 ,,
Mangalore ,,	Med Brown to good bold	2/6 a 5/3 ,,
Ceylon, Mysore ,,	Small fair to fine plump	2/ a 5/
Malabar ,,	Fair to good	1/7 a 1/8
Seeds, E. I. & Ceylon ,,	Fair to good	2/ a 2/3
Ceylon "Long Wild" ,,	Shelly to good	1/ a 1/6 nom
CHILLIES, Zanzibar cwt.	Dull to fine bright	75/ a 85/
Japan ,,	Fair bright small	60/ a 70/
CINCHONA BARK.—lb.	Crown, Renewed	3⅜d a 7d
Ceylon	Org. Stem	2d a 6d
	Red Org. Stem	1¾d a 4¼d
	Renewed	3d a 5¼d
	Root	1⅞d a 4d
CINNAMON, Ceylon 1sts.	Fair to stout quill	2/6
per lb. 2nds.	,, ,,	2/3
3rds.	,, ,,	2/
4ths.	,, ,,	11d
Chips,	Fair to fine bold	10½d a 1/
CLOVES, Penang lb.	Dull to fine bright pkd.	3/6 a 4/
Amboyna ,,	Dull to fine	2/ a 2/6
Zanzibar ,,	Fair and fine bright	1/9 a 1/10
Madagascar ,,	Fair	1/9 a 1/10
Stems ,,	Fair	7½d
COFFEE		
Ceylon Plantation cwt.	Medium to bold	Nominal
Liberian ,,	Fair to bold	,,
COCOA, Ceylon Plant. ,,	Special Marks	87/ a 90/
	Red to good	80/ a 88/
Native Estate ,,	Ordinary to red	50/ a 76/
Java ,,	Small to good red	70/ a 96/
COLOMBO ROOT ,,	Middling to good	100/ a 120/
CROTON SEEDS, sifted,,	Dull to fair	70/ a 75/
CUBEBS ,,	Ord. stalky to good	£16/ a £18/
FIBRE, Kitul lb.	OOO good long	10d a 11d
	OO ,, medium	8½d
	No. 1 fair	7d
Palmyrah ton.	Common to fair	£30/ a £35 nom.
,,	Medium to good med	£40/ a £45 ,,
	Good to fine	£50/ a £60 ,,
GINGER, Bengal, rough cwt.	Fair	62/6
Calicut, Cut A ,,	Medium to fine bold	100/ a 110/
B & C ,,	Small and medium	90/ a 100
Cochin, Rough ,,	Common to fine bold	67/6 a 72/6
	Small and D's	67/6
Japan ,,	Unsplit	50/ a 52/6
GUM Ammoniacum ,,	Ord. blocky to fair clean	175/ a 200 nom.
Animi, Zanzibar	Pale and amber, str. srts	£14 10/a £16 10/
,,	,, ,, little red	£11 a £12
,,	Bean and Pea size ditto	70/ a £11
,,	Fair to good red sorts	£8 10/ a £10 10/
,,	Med. and bold glassy sorts	£5 10/ a £7 5/
Madagascar ,,	Fair to good palish	£4 a £8
	,, ,, red	£4 a £7
Arabic, E. I. & Aden ,,	Ordinary to good pale	55/ a 75/
Turkey sorts ,,	... ...	85/ a 87/6
Ghatti ,,	Sorts to fine pale	30/ a 50/
Kurrachee ,,	Reddish to good pale	35/ a 50/ nom.
Madras ,,	Dark to fine pale	30/ a 45/ nom.
Assafœtida ,,	Clean fr. to gd. almonds	£15 a £20
	com. stony to good block	£4 a £10
INDIGO, E.I. Bengal lb.	Shipping mid to gd. violet	10/ a 13/
,,	Consuming mid. to gd.	9/ a 10/
,,	Ordinary to middling	8/6 a 9/6
,,	Mid. to fine Kurpah	7/ a 9
,,	Low to ordinary	5/ a 6/9
,,	Mid. to fine Madras	2/6 a 4/6
KAPOK-Ceylon lb.	Ordinary to good	1/ a 1/4
KINO lb.	Fair to fine bright	6d a 1/5
MYRRH, Aden sorts cwt.	Middling to good	170/ a 200/
Somali ,,	,, ,,	140/ a 160/
MACE, Bombay & Penang		
per lb.	Pale reddish to fine	3/6 a 4/
	Ordinary to fair	3/ a 3/6
Java	,, ,, good pale	3/6 a 4/
Bombay	Wild	8d

	QUALITY.	Quotations.
NUTMEGS,— lb.		
Singapore & Penang ,,	64's to 57's	2/ a 2/6
	80's	1/11
	110's	1/6
NUX VOMICA, Cochin	Ordinary to good	42/6 a 45/
per cwt. Bengal	,, ,,	35/ a 40/
Madras	,, ,,	37/6 a 42/6
OIL OF ANISEED lb.	Fair merchantable	4/3
CASSIA ,,	According to analysis	6/ a 6/3
LEMONGRASS oz.	Good flavour & colour	5d
NUTMEG ,,	Dingy to white	1½d a 1¾d
CINNAMON (Ceylon)	Ordinary to fair sweet	6d a 2s
CITRONELLE ,, lb.	Bright & good flavour	2/4
OLIBANUM, drop cwt	Good to fine white	130/ a 150/
,,	Middling to fair	100/ a 120
pickings ,,	Low to good pale	22/6 a 40/
siftings ,,	Slightly foul to fine	35/ a 45/
ORCHELLA WEED—cwt		
Ceylon ,,	Fair	10/6
Madagascar ,,	Fair	10/6
Zanzibar ,,	Fair	10/6
PEPPER—(Black) lb.		
Alleppy & Tellicherry	Fair	1/3 a 1/3½
Ceylon ,, ,,	Fair to fine bold heavy	1/2 a 1/4
Singapore ...	Fair	1/2¾
Acheen & W. C. Penang	Dull to fine	1/2
(White) Singapore ,,	Fair to fine	1/8
Siam ,,	Fair	1/8½
Penang ,,	Fair	none
Muntok ,,	Fair	1/8½
RHUBARB, Shenzi ,,	Ordinary to good	1/4 a 3/
Canton ,,	Ordinary to good	1/3 a 2/6
High Dried,,	Fair to fine flat	1/7 a 1/9
RUBBER, INDIA lb.	Standard smoked sheets	2/4½
Ceylon, Straits, ,,	Standard Crepe	2/5½
Malay Straits, etc. ,,	Scrap fair to fine	1/8
Assam ,,	Fair 11 to ord. red No. 1.	1/4
Rangoon ,,	,, ,, ,,	1/6
Borneo ,,	Common to good	1/6
Java ,,	Good to fine red	1/8 a 1/10
Penang ,,	Low white to prime red	1/6 a 1/9
Mozambique ,,	Sausage, fair to good	1/6 a 2/
Nyassaland ,,	Fair to fine ball	1/6 a 2/
Madagascar ,,	Fr. to fine pinky & white	1/4 a 1/7
,,	Majunga & blk coated	1/
,,	Niggers, low to good	9d a 1/6
New Guinea ,,	Ordinary to fine ball	1/6 a 2/
SAGO, PEARL, large--cwt	Fair to fine	50/ a 65/
medium ...	,, ,,	50/ a 65/
small ...	,, ,,	50/ a 65/
Flour ...	Good pinky to white	40 a 77/6
SEEDLAC cwt.	Ordinary to gd. soluble	225/ a 250/ nom.
SENNA, Tinnevelly lb.	Good to fine bold green	10d a 11d
	Fair greenish	6½d a 9d
	Common specky & small	3½d a 5½d
SHELLS, M. of PEARL—		
Egyptian cwt.	Small to bold	40/ a 25 10/ nom
Bombay ,,	,, ,,	55/ a £5 15/ ,,
Mergui ,,	Chicken to bold	£6 15/ a £10 15/
Manilla ,,	,, ,,	£6 a £10/ nom
Banda ,,	Sorts	40/ a 45/ ,,
Green Snail,,	Small to large	50/ a 75 ,,
TAMARINDS, Calcutta...	Mid to fine bl'k not stony	45/ a 50/
per cwt. Madras	Inferior to good	25/ a 35/
TORTOISE SHELL—		
Zanzibar & Bombay lb.	Small to bold	10/ a 25/
	Pickings	5/ a 15/
Ceylon	Small to bold	10/ a 22/
Mauritius & Seychelles	,, ,,	10/ a 25/
TURMERIC, Bengal cwt.	Fair	50/
Madras ,,	Finger fair to fine bold	55/ a 60/
Do. ,,	Bulbs ,, ,, bright	45/ nom.
Cochin ,,	Finger fair	50/ nom.
	Bulbs ,,	37/6
VANILLA.— lb.		
Mauritius ... 1sts.	Gd. crystallized 3½a 8½ in.	5/6 a 9/6
Madagascar ... 2nds.	Foxy & reddish 3½a ,,	5/ a 7/
Seychelles ... 3rds	Lean and inferior	5/ a 5/9
WAX, Japan, squares, cwt.	Good white hard	92/5



HIS EXCELLENCY THE LATE SIR JOHN ANDERSON, G.C.M.G., K.C.B., LL.D.
Late Governor of Ceylon and President, Ceylon Agricultural Society.